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Illuminating Engineering Society, New York Section.

ILLUMINATING ENGINEERING SOCIETY, NEW YORK SECTION,
OFFICE OF THE SECRETARY,
227 FULTON STREET, March 31, 1910.

The regular meeting of the New York Section, Illuminating Engineering Society, for the month of April, will be held in the regular meeting hall on the evening of Thursday, April 14, in the United Engineering Society's Building, 29 West 39th street, New York city.

The papers of the evening will be "The Relationship of Fixture Design to the Illuminating Engineering Practice," by L. R. Hopton and H. E. Watkins, and "On Finite Surface Sources," by Bassett Jones, Jr.

A. J. MARSHALL, Sec'y.

[OFFICIAL NOTICE.]

Second Annual Meeting, Pennsylvania Gas Association.

PENNSYLVANIA GAS ASSOCIATION,
OFFICE OF SECRETARY-TREASURER,
LEBANON, PA., Feb. 26, 1910.

To the Members of the Pennsylvania Gas Association: The meeting of the Pennsylvania Gas Association will be held in Easton, Pa., April 13, 14 and 15, 1910. Headquarters will be the Karldon Hotel. The following papers have been prepared:

"Distribution Shop Practice," by J. E. Arthur, Reading, Pa.

"Gas Meters from the Meter Man's Standpoint," by J. H. Mansur, Royersford, Pa.

"New Business: Methods for Solicitors' and Employees' Meetings," by George W. Thomson, Chester, Pa.

"Qualifications for Successful Manager of Public Service Corporation," by B. F. Cresson, Easton, Pa.

"Motor Cycle and Automobile Experience," by L. S. Williams, Harrisburg, Pa.

"Lecture on Illuminating Engineering," Norman Macbeth, Philadelphia, Pa.

"Lecture on Tar as Applied to Road Building," W. H. Fulweiler, Philadelphia, Pa.

"Gas Arcs: Installation and Maintenance," by J. H. Keppleman, Reading, Pa.

"Water Heating and Type of Apparatus for Residences," by H. D. Gillingham, Wilkes-Barre, Pa.

"Profitable Gas Advertising," by W. R. Rhoades, Williamsport, Pa.

"Burner Maintenance in Residence Districts," by F. J. Rutlege, Philadelphia, Pa.

"Coal Gas Manufacture," by W. H. Merritt, Lebanon, Pa.

"Experience with Measuring Devices for Air, Steam and Temperature as Applied to Water Gas Apparatus," by John A. Frick, Allentown, Pa.

Short Exchange Topics:

"Office Forms and Help," and "Maintaining Constant Candle Power During Year," by L. R. Dutton, Wyncote, Pa.

Arrangements have been made for a theater party, an informal dinner and to visit the plant of the Ingersoll-Rand Drill Company.

Everybody interested in the gas industry is cordially invited to attend.

Respectfully, W. H. MERRITT, Sec'y.

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[OFFICIAL NOTICE.]

Southwestern Electrical and Gas Association.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION,
OFFICE OF SECRETARY,
DALLAS, TEX., Feb. 28, 1910.

The 6th annual convention of the Southwestern Electrical and Gas Association will be held in Beaumont, Tex., on May 12, 13 and 14, 1910.

D. G. FISHER, Asst. Sec'y.

[Official Notice.]

Fourth Annual Convention, Missouri Electric, Gas, Street Railway and Water Works Association.

Missouri Electric, Gas, Street Railway and Water Works Association,
Office of Secretary, March 30, 1910.

The meeting will be held at the Madison Hotel, Jefferson City, April 14, 15 and 16, 1910. Arrangement of the sessions will be as follows:

Thursday, 14.—Morning business session, followed by visit to Penitentiary Power plant. Afternoon Session.—"Luminous Arc Rectifier System," by Mr. Louis Friedman. "Securing Profitable Day Load," by Mr. J. E. Harsh. Evening.—Smoker.

Friday, 15.—"Condensers for Small Central Stations," by Mr. Chas. S. Lewis. Report of Committee on Accounting and Records, by Mr. N. J. Cunningham. Afternoon Session.—"Vertical Gas Retorts," by Mr. S. Watts. "Electrically Driven Water Works Plants," by Mr. H. W. Clark. "The Primary Law Pertaining to Public Utilities," by Mr. Geo. McCollum. Evening.—Banquet.

Saturday, 16.—"Data on Electric Plants," by Prof. H. B. Shaw. "American Diesel Oil Engine: Power Plants in Public Service," by Mr. Edwin S. Harrison. Afternoon Session.—General Open Discussion. Executive Session. Base Ball Game: Central Station Men *vs.* Supply Men.

C. L. Clary, Sec'y.

BRIEFLY TOLD.

Death of Mr. Fayette Brown.—Mr. Fayette Brown, known throughout the gas world as the senior member of the Brown Hoisting Machinery Company, of Cleveland, O., and throughout the general manufacturing world from his extensive connection with the iron trade of America, died at his home, 3210 Euclid avenue, Cleveland, the morning of January 20th. Since last June he had been in failing health, primarily due to the effects of a heat prostration visited upon him there. He was born in North Bloomfield, Trumbull county, O., December 17, 1823, and was the son of Ephraim Brown, one of the first settlers of Bloomfield township. His early education was obtained in the public schools of Gambier, O., and the final touches thereto were secured in Jefferson College, Pennsylvania. His first business venture was made in the drygoods shop of an older brother, a resident of Pittsburgh, Pa., and in 1845 he was admitted to partnership in the concern. On or about 1850 he acquired an interest in the Mygatt banking house, located in Cleveland, and in 1851 he formed the partnership of Mygatt & Brown. In 1852 the first named retired from active business and the deceased alone conducted the business until shortly after the outbreak (1861) of the Civil War. In that year he was appointed a paymaster in the service of the Union Army, but resigned the position (after serving 1 year), retiring with the rank of Major. Towards the close of 1862 he returned to Cleveland, to take up the duties of General Agent and Manager of the Jackson Iron Company. From then on his rise in the business world was rapid, and everything in which he engaged himself prospered well. This was not to be wondered at, for he was a most resourceful, tactful, painstaking, honorable man. Besides the industry named above he was closely identified with the fortunes of Union Screw Company, the National Chemical Company, the G. C. Kuhlman Car Company, a member of the Stewart Iron Company and of the prominent iron ore dealing firm of H. H. Brown & Co. In banking lines he was forceful in the direction respectively of the Cleveland Trust Company and of the Cleveland National Commercial Bank. Naturally, as might well and easily be determined from the above listings, he was prominent in the social, political and religious life of Cleveland, and although well on in years his name was on the roster of many Cleveland Clubs—especially those given over to the communing of men thoroughly interested in fishing and gunning. His wife, Cornelia Brown (to whom he was married in 1847), died some years ago, and of that union four children survive—the Misses Florence C. and Mary L., and Alexander E. (Vice-President and General Manager of the Brown Hoisting Machinery Company), and H. H. Brown, active head of the well-known Cleveland firm of H. H. Brown & Co. Deceased was noted for his unostentatiousness and for the plethora of his charities, and Cleveland, while mourning his death, may also rejoice in having had for a goodly stretch a citizen who was of such exceeding worth.

Current Mention.—

Mr. H. H. Jones has been appointed Manager of the San Diego (Cal.) Consolidated Gas and Electric Company; he succeeds Mr. C. E. Groesbeck. This Company declared the regular quarterly dividend of 1¾ per cent. on its preferred stock to holders of record on the 31st ult.

[Prepared for the Journal.]

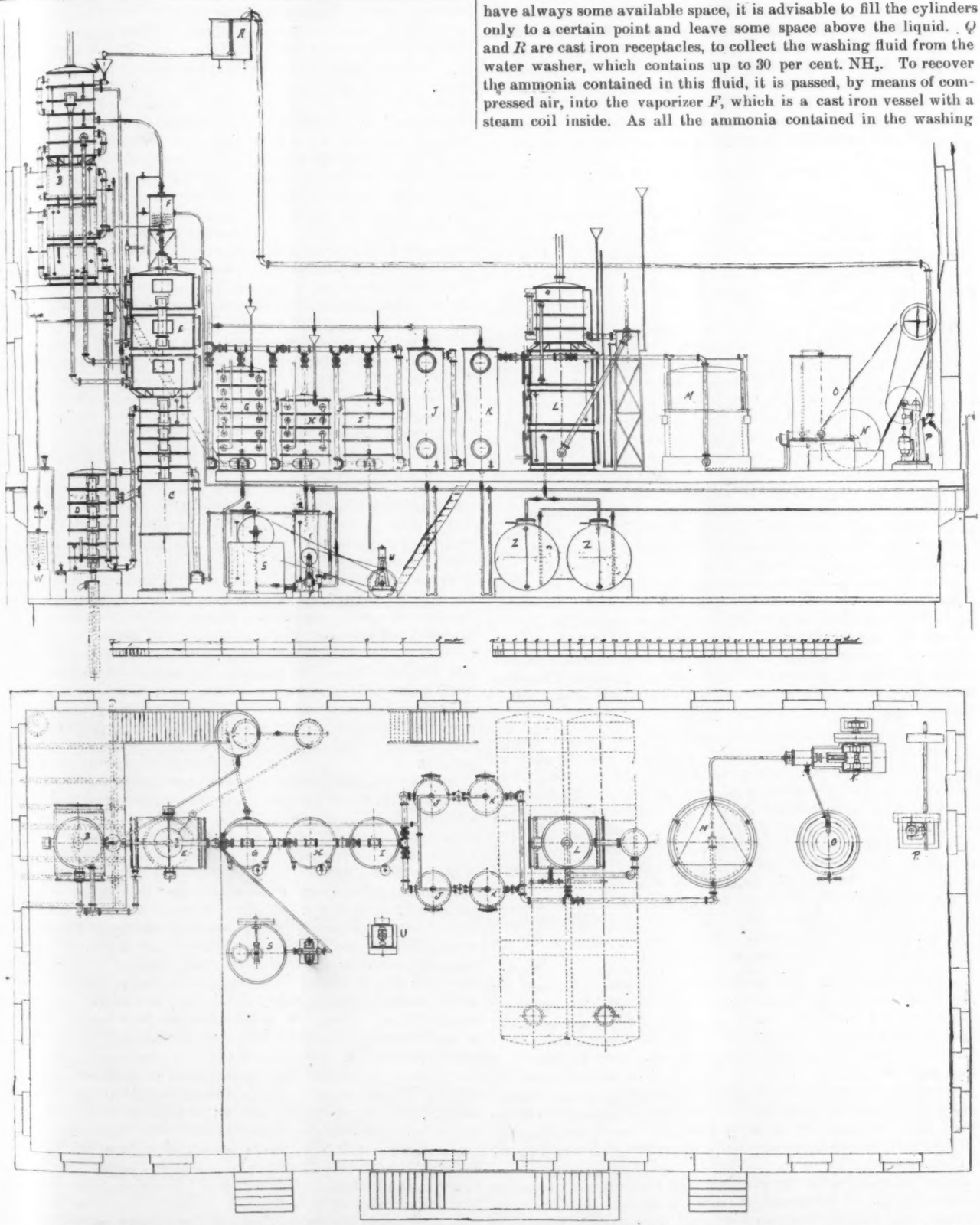
The Manufacture of Aqua Ammonia and Anhydrous Ammonia.

[By Mr. R. W. Hilgenstock, Leipzig, Plagwitz.]

When in very hot summer days the average citizen enjoys his ice cream soda or "a nice cold drink," he never thinks what trouble and complicated apparatus it takes, until the artificial ice in his high ball or cocktail is produced and ready for use, and had it not been for the development of the ammonia industry, which again was due to progress in the operating of gas works and coke oven plants, with the recovery of by-products, the artificial ice would not be sold as cheap to-day as it is.

The following paragraphs are written for the purpose of making the readers of the Journal better acquainted with the process through which the crude ammonia has to go until it is ready for the use in ice in the refrigerating machines, and to make good a promise, which the writer has given his esteemed friend and editor of this paper, Mr. Thos. J. Cunningham, more than a year ago.

The crude gas liquor, which is pumped from the well into the feed regulator *A*, by pump *P*, after leaving the regulator, enters the top section of the carbonic acid still *B*, and travels down the different sections of this apparatus, absorbing on its way the ammonia, which might have escaped from the heating chambers arranged below the round sections. On its way downwards, the crude gas liquor is further used for cooling purposes, by bringing it into the lowest chamber of the cooler *E*, and after it has been preheated here, in cooling at the same time the vapors that come from the still, it is brought back to the section arranged below that it left. After leaving the last absorbing section, the crude liquor enters the first heating chamber of the apparatus, then the second and finally the last. In these three chambers it is gradually heated up to 93° to 95° C., and by this process from 70 to 75 per cent. carbonic acid and from 60 to 65 per cent. sulphuretted hydrogen are eliminated. This elimination of the two gases is of great advantage, because it means an immense saving of lime and alkali; had all the CO_2 and H_2S been left in the liquor, larger washing apparatus must have been provided, as it is an absolute necessity to remove even the smallest particles of CO_2 and H_2S, a manipulation which is by no means an easy one. Coming back to the heating chambers it must be said again, that it cannot be avoided, that together with CO_2 and H_2S some ammonia escapes, but inasmuch as the gases have to pass several absorbing sections, as mentioned above, which are always fed with fresh, cool liquor, the ammonia will be absorbed again, so that only CO_2 and H_2S can escape through the vent pipe, which is arranged on top of the still. From the last heating chamber the hot liquor flows through a deep seal into the top section of the still *C*; the first 6 sections are arranged to eliminate all the so-called free ammonia, while in the lower large chamber, and in the sections of the still *D* the fixed ammonia is set free after milk of lime of a certain strength from the mechanical lime mixer *S* is pumped into the large chamber by means of pump *T*, which again, as well as the paddle in the lime mixer, are driven by a small steam engine, *U*. The steam ammonia vapors from the stills *D* and *C*, which leave the top section of still *C*, enter the cooler *E*, which is composed of three independent sections, in which most of the steam vapors, mixed with the ammonia gases, are condensed, so that the ammonia gas that leaves the top section of the cooler is almost dry. This ammonia gas now passes the water washer *G*, the alkali washer *H*, and the oil washer *I*, filled with water, hydrate of sodium solution and paraffine oil, respectively. While in washers *G* and *H* the last parts of CO_2 and H_2S are retained, serves washer *I* the purposes to absorb tarry oil vapors. In order to do away with the so-called "empyreuma," which is the collective name for very bad smelling, tarry substances, the ammonia gas is filtered in 2 charcoal and 2 boneblack filters, marked *J* and *K*, respectively. When the ammonia gas leaves the last boneblack filter it is ready for absorption in "distilled water" or for compression into "liquid ammonia." The distilled water, by the way, is recovered from the steam coils in the heating chambers of the carbonic acid still *B*. In case aqua ammonia is to be made, the ammonia gas is brought into the absorbing apparatus *L*, which is of special construction and provided with large cooling coils to keep down the chemical heat created by the absorption of ammonia in water; the apparatus is further arranged in such a way that the absorption can be continuous and that any strength of liquor up to 32.5 per cent. NH_3 may be obtained. When the ammonia gases are to be compressed, the absorber is by-



passed and instead the gases enter the gasholder *M*, which merely acts as pressure regulator, and from where the compressor *N* suctions and compresses them in two stages into liquid ammonia; of course, great heat is generated by the compression, and it would be hard to get the gases in a liquid form. To do away with this heat, the gases are cooled again in the cooler *O*, and can now be tapped into steel cylinders, containing from 50 to 100 pounds of liquid ammonia. The pressure in these cylinders under ordinary temperature is about 125 pounds per square inch; in very warm summer days, of course, it can come up to 400 and 500 pounds per square inch, and to have always some available space, it is advisable to fill the cylinders only to a certain point and leave some space above the liquid. *Q* and *R* are cast iron receptacles, to collect the washing fluid from the water washer, which contains up to 30 per cent. NH_3. To recover the ammonia contained in this fluid, it is passed, by means of compressed air, into the vaporizer *F*, which is a cast iron vessel with a steam coil inside. As all the ammonia contained in the washing fluid is free ammonia, it needs only a little steam for driving it off. The ammonia gases are led into an absorbing section of the carbonic acid still, where the ammonia is absorbed by the crude weak liquor, while the rest of the washing fluid goes back into the system again, by opening the cock, arranged below the vaporizer. The apparatus as described above is of ample size to work up from 25,000 to 30,000 gallons of crude ammonia liquor containing about 1½ per cent. NH_3.

THE capital stock of the El Paso (Tex.) Gas and Electric Company has been put at $645,000; an increase of $145,000.

[Continued from Page 585.]

REPORT OF PROCEEDINGS, FOURTH ANNUAL MEETING, AMERICAN GAS INSTITUTE.

Held in the Hall of Elks, Detroit, Mich., October 20, 21 and 22, 1909.

Second Day—Afternoon Session, Oct. 21, 1909.—*Technical Session.*

The Chairman here introduced Mr. Chas. D. Robison, who read the following paper on

POWER PLANTS FOR GAS WORKS OF MEDIUM SIZE.

The development of the electic motor drive and the increased use of the gas engine have recently led to the installation of one or both of these types of motor in gas works, while at the same time a steam engine drive has been retained in the same plant for certain purposes. In this paper the writer has tried to determine if, under certain specified conditions, either of these forms of drive is justified, and if so the probable saving obtained by such use.

No original testing of apparatus has been attempted, but a thorough search has been made for reliable information in regard to the efficiency of the different machines that are used in both coal and carburetted water gas works. It would require too much space to mention all of the authorities consulted, but many of the figures have been taken from the paper read by Mr. Alten S. Miller, before the New York meeting of the American Gas Light Association, in 1899, and appearing in the report of the "Proceedings" of that meeting.

As a basis of comparison, the cost of installation and operation of a power plant for a gas works, having a maximum daily capacity of 2,000,000 cubic feet of coal gas, and 1,000,000 cubic feet of carburetted water gas, and an annual output of 480,000,000 cubic feet of coal gas and 240,000,000 cubic feet of carburetted water gas, has been taken. A partial design for this plant was prepared so that the investment for the different types of installation could be determined and the transmission losses calculated. In choosing a plant of this particular capacity, it was thought that the possibilities of economy on both larger and smaller plants would be clearly indicated. The steam consumption of the different steam-driven units was determined as follows:

Three coal gas exhausters, of a capacity of 1,000,000 cubic feet per day, would be required, one to operate constantly, and the other 200 days in the year, one being always in reserve. As not over 1.2 per cent. of the value of the steam is recovered in useful work, the number of cubic feet to be pumped makes little difference in the steam consumption of this apparatus. It should be stated that whenever the word efficiency is used in this paper, the efficiency on a heat basis is intended, that is to say, the heat equivalent of the useful work actually accomplished by the apparatus is compared with the total heat of the steam supplied to it to accomplish this work. Each machine would require while in operation 600 to 650 pounds of steam per hour, and on a basis of 600 pounds of steam per hour would use approximately 8,200,000 pounds per annum.

In Mr. Miller's paper it was stated that 10.8 pounds of steam per 1,000 cubic feet of gas manufactured were required for operating pumps used in a carburetted water gas plant, and it is probable that about the same amount is required in a coal gas works. Theoretical calculations show about 9 pounds, and in this paper 10 pounds of steam per 1,000 cubic feet of gas manufactured has been assumed.

The steam consumption of the scrubbers would be constant during operation, irrespective of the flow of gas through them. It was assumed that one machine would operate 8,760 hours and the other 4,320 hours in the year, and that the steam consumption would be 300 pounds per hour.

The power required for operating the coal crushers and conveyors was determined, but no attempt was made to include the machinery necessary for placing and removing coal from storage, because it would vary so much in each installation.

The total power required for the crushers and conveyors would be 50-brake horse power, with an average load of 40-brake horse power 5 hours each day. A simple slide valve, high speed engine at this load would use about 60 pounds of steam per brake horse power per hour. The coke conveying machinery, coke elevators and screens, would require at full load 50-brake horse power, and would operate 6 hours per day at an average load of 40-horse power. The engine would be of the same type as the coal crushing engine, using 60 pounds of steam per brake horse power per hour. The combined charging and discharging machine would require a maximum of 20-horse power, and would average about 10-horse power while in use, which would be about 7 hours per day. The type of engine used on this machine would require approximately 80 pounds of steam per brake horse power.

As there are about 5 pounds of ammonia produced per ton of coal carbonized, and as this is held in a liquor averaging about 1½ per cent. of ammonia by weight, there is approximately 330 pounds of ammoniacal liquor produced per ton of coal carbonized. This liquor is concentrated from 1½ per cent. to 18 per cent., consequently there will be about $\frac{1}{12}$ of the weight of the liquor raised to the boiling point and driven over as steam, say 27.8 pounds. The liquor supplied to the concentrator would have an average temperature of about 70°, and since 1,100 B.T.U.'s are required to raise water from 70° and turn it into steam at atmospheric pressure, for that part of the liquor vaporized there would be required $27.8 \times 1,100 = 30,580$ B.T.U. The balance of the liquor would be heated from 70° to 200°, requiring 130 B.T.U. per pound, or $305.2 \times 130 = 39,676$ B.T.U. This gives 70,250 B.T.U. as the amount of heat required to concentrate the ammoniacal liquor produced in the carbonization of 1 ton of coal. The waste from the concentrator is at about 120°, so for each pound of steam supplied for heating there are 1,050 B.T.U. available, on which basis 66.9 pounds of steam would be required per ton of coal carbonized if the concentrator operated at 100 per cent. efficiency, but as the efficiency of this type of apparatus is not over 80 per cent., 83.6 pounds of steam should be supplied.

A test in Philadelphia, Pa., on a 1,333,000 cubic foot holder, reported in the proceedings of the American Gas Institute, page 682, Vol. 3, gives 100 tons as the total coal required for heating the holder and cups for one season. Correcting these figures for a climate more nearly representative of that existing throughout New England, New York and the Middle States, and for the difference in capacity between this holder and the 2,500,000 cubic foot holder required for this plant, the annual steam consumption would be 2,292,000 pounds. It is probable that heat would have to be supplied about 130 days in the average season, making the average hourly consumption 735 pounds and the maximum 1,500 pounds. The amount of steam needed for heating the building was calculated from the size of the buildings. In extreme winter weather 40 B.T.U. per hour per square foot of exposed wall surface would be required, giving a maximum hourly consumption of 800 pounds, and an average of 400 pounds for this purpose.

Condensation and leakage would vary greatly in each plant, due to the manner in which the piping was laid out and maintained. The amount of this loss shown in several tests varies from 8 per cent. to 15 per cent. of the output of the boilers. For the purpose of this paper I have taken 10 per cent. in each case, which is as low as would probably be obtained.

The steam consumption of the pumps used in a carburetted water gas plant is taken at 8 pounds per 1,000 cubic feet of gas made. Mr. Miller gives 10.8 pounds, but by selecting pumps designed for the work to be done, the lower figure should be ample. The blower for this plant would require a 60-horse power engine, which would operate ½ the time at ¾ load, while the plant was in operation, which would be approximately 5,760 hours per year, giving 2,880 engine hours at ¾ load. Under these conditions the type of engine that would be used would require about 2,700 pounds of steam per hour or 7,776,000 pounds per annum. The exhauster in this plant would operate 5,760 hours, using 460 pounds of steam per hour, or 2,650,000 pounds per annum. The steam consumption of the generator and oil heater was taken at the figures given in Mr. Miller's paper, 29.5 pounds, and 4 pounds per 1,000 cubic feet respectively.

A maximum of 10-horse power would be required to operate the tools in the workshop. This engine would run about 2,200 hours in a year, and use about ⅔ of its full load requirements, or 400 pounds of steam per hour while running.

In determining the boiler capacity that should be installed, a boiler horse power has been taken as 34 pounds of water turned into steam per hour. The maximum demand of each piece of apparatus was determined by calculating the maximum steam requirements over a period of 30 minutes, and dividing that by $\frac{34}{2}$. These results were totaled and ⅓ was added for reserve to allow for cleaning and repairs.

In visiting numerous gas works the writer has been impressed with the frequency with which freak types of boilers have been installed. A gas works is a poor place to work out experiments in boiler design, due to the small size of the boiler plant, the small proportion that the

cost of boiler fuel bears to the other expenses of plant operation, to the relatively small amount of intelligent care given to this end of the business, and to the great variations of fuels that are used. From considerable personal experience, and from conversations with many men employed in boiler house work, it appears that some standard form of water tube boiler, in the great majority of cases, is the best steam generator to use. This is due to the great overload capacity of this type of boiler, and to the probability that they will be kept cleaner than other types, owing to the ease with which scales in the tubes can be detected, as compared with other kinds of boilers. The cost of boilers in units of 200-horse power is taken at $15 per horse power erected., including ordinary foundations and steel stacks.

Table No. 1 is prepared in conformity to the foregoing, and Table No. 2 is the same as Table No. 1, except that all exhaust steam available has been used for heating and credited at the rate of 70 per cent. of the value put into the engine. The cost of piping and engines, given in Tables Nos. 1 and 2, was taken from recent quotations. The piping is all high grade work, and when placed inside of the buildings is covered with magnesia covering, and when placed outside laid underground in wooden logs.

In calculating the steam required for motor drive, a steam consumption of 40 pounds per kilowatt hour of net station output, using a compound, non-condensing engine, has been taken. The transmission and motor losses would not exceed 18 per cent., giving a steam consumption of 48.7 pounds per kilowatt hour, equal to 36.2 pounds per horse power hour delivered at the end of the motor shaft. Before discussing the steam consumption of the different apparatus electrically driven, it would be well to take up the characteristics of the current supplied. The advantage of direct current over alternating current is that variable speed direct current motors can be sup-

TABLE NO. 1.—*Steam Consumption with all Steam Drive and Live Steam Used for all Purposes Except Heating Feed Water.*

Apparatus: Coal Gas Plant.	Maximum Steam Consumption per Hr. in Pounds.	Average Steam Consumption per Hr. in Pounds.	Hours per Year in which Apparatus will be Operated.	Yearly Steam Consumption in Pounds.	Boiler Horse Power Required.	Price of Engine Including Foundations and Connections to Machines.	Cost of Steam Connections to Engine.
Three exhausters, 1,000,000 cubic feet daily capacity each..	690	535	8,760	8,200,000	35.0	$1,050	$115
Two standard scrubbers	600	446	8,760	4,700,000	20.2	1,050	115
Pumps for all purposes	1,000	625	8,760	5,475,000	29.4	....	100
Coal crushers and conveyors	2,400	2,400	1,820	4,380,000	70.5	1,800	60
Coke conveyors and screens	2,400	2,400	2,190	5,250,000	70.5	1,900	60
Charging and discharging machines	800	800	2,555	2,050,000	....	2,652	...
Ammonia concentrator	2,400	2,400	1,675	4,012,000	70.5	....	70
Holders (heating)	1,500	750	3,120	2,340,000	44.0	....	...
Buildings (heating)	800	400	3,120	1,250,000	23.5	....	...
Condensation and leakage (10 per cent.)	440	440	8,760	3,866,000	13.0	....	...
Totals	....	....	....	40,747,000	372.0	$7,912	$520
Apparatus: Carburetted Water Gas Plant.							
Pumps	360	330	5,760	1,920,000	10.1	....	115
Blower engine	2,700	1,350	5,760	7,776,000	80.0	2,200	80
Exhauster engine	460	460	5,760	2,650,000	13.5	350	80
Generator	1,225	1,225	5,760	7,100,000	37.0	....	180
Oil heater	170	170	5,760	960,000	5.0	....	50
Condensation and leakage (10 per cent.)	334	334	5,760	1,930,000	9.8	....	...
Totals of carburetted water gas plant	....	...	....	22,336,000	155.4	2,550	505
Workshop	600	400	2,200	880,000	17.8	930	70
Condensation and leakage (10 per cent.)	....	...	....	110,000	0.4	....	...
Totals required for workshop	....	...	....	990,000	18.2	930	70
Total boiler horse power for entire plant for all purposes	....	...	....	.....	546.6	....	...
Reserve boiler capacity required	....	...	....	.....	179.4	....	..
Total boiler capacity installed	....	...	....	.....	725.0	10,875	330
Yard connection, high pressure steam lines only	....	...	....	.....	....	....	4,490
Totals	....	...	....	64,073,000	725.0	$22,267	$5,915

TABLE NO. 2.—*Steam Consumption with all Steam Drive and Exhaust Steam Used for all Heating Purposes Wherever Available.*

Apparatus: Coal Gas Plant.	Maximum Steam Consumption per Hour in Lbs.	Average Steam Consumption per Hour in Lbs.	Hours per Year in which Apparatus will be Operated.	Yearly Steam Consumption in Lbs.	Boiler Horse Power Required.	Price of Engine Including Foundations and Connections to Machines.	Cost of Connections to Engine.
Three No. 6 Roots' exhausters	1,200	930	8,760	8,200,000	35.0	$1,050	$300
Two Standard scrubbers	660	446	8,760	3,920,000	15.6	510	300
Pumps for all purposes	1,000	625	8,760	5,474,000	29.4	....	200
Coal crushers and conveyors	2,400	2,400	1,820	4,380,000	70.5	1,800	250
Coke conveyors and screens	2,400	2,400	2,190	5,250,000	70.5	1,900	250
Charging and discharging machines	800	800	2,555	2,050,000	....	2,652	....
Ammonia concentrator	2,400	2,400	650	1,570,000	70.5	....	100
Holders (heating)	....	....	....	....	....	....	....
Buildings (heating)	....	....	....	....	....	....	....
Condensation and leakage (10 per cent.)	370	370	8,760	3,046,000	10.8	....	....
Totals	....	....	....	33,890,000	302.3	$7,912	$1,400
Apparatus; Carburetted Water Gas Plant.							
Pumps	360	330	5,760	1,920,000	9.7	.....	250
Blower engine	2,700	1,350	5,760	7,776,000	80.0	2,200	200
Exhauster engine	460	460	5,760	2,650,000	13.5	350	200
Generator	1,225	1,225	5,760	7,100,000	37.0	....	180
Oil heater	....	....	....	....	....	....	60
Condensation and leakage (10 per cent.)	310	310	5,760	1,790,000	9.2	....	....
Totals of carburetted water gas plant	....	....	....	21,236,000	149.4	2,550	890
Workshop engine	600	400	2,200	880,000	17.8	930	890
Condensation and leakage 10 per cent.)	....	....	....	110,000	0.4	....	....
Totals required for workshop	....	....	....	990,000	18.2	930	180
Total boiler horse power for entire plant for all purposes	....	....	....	....	469.9	....	....
Reserve boiler capacity required	....	....	....	....	142.8	....	....
Total boiler capacity installed	....	....	....	....	625.0	9,375	330
Yard connection, high pressure steam and exhaust lines	....	....	....	....	....	....	6,590
Totals	....	....	....	56,116,000	625.0	$20,767	$9,390

plied to give almost any range of speed required, while only 2 or 3 variations are practicable with alternating current motors, but as the regulation of the direct current motors is not close enough to be used for coal gas exhausters without also using a compensator to regulate the gas, and as all classes of coal handling machinery and charging machines are now made when required to be driven by alternating constant speed or 2-speed motors, this advantage is not great. On the other hand, the danger of fire or explosion from sparking, which is constant and unavoidable in the direct current motor, is entirely removed when certain types of alternating motors are used. The difference in cost is slightly in favor of the direct current motor, but this is more than compensated for by the lower maintenance charges against the alternating current type. In the present state of development there is no reason why the entire plant should not be driven by alternating current motors. Having decided on alternating current the phase and alterations to use must be determined. Two-phase has no advantage over 3-phase current, and does not lend itself as readily to 2 speeds, while the cost of wiring is somewhat greater; 60-cycle current is better adapted for lighting than any having fewer alternations, but slow speed motors of this type are very large for the power developed, and in the small sizes are all special motors. With 25-cycle current the lighting would be poorer, but would answer perfectly every purpose about a gas works, and as the demand is for slow speed motors, which can be supplied as standard and at much lower cost for 25 than for 60-cycle current, this number of alternations has been selected.

There are no advantages to be gained where the distance covered is as small as in this plant that would compensate for the dangers entailed by the use of high voltage current. The cost of wiring would be less with 2,200 volts than with 220 volts, but the precautions to be taken to make the higher voltage safe, and the cost of transformers to step it down for use in the motors, or the additional cost of high voltage motors, and, more than anything else, additional danger to life and property, would indicate that low voltage should be used. Consequently the current best adapted for this use seems to be 220 or 440-volt, 3-phase, 25 cycle alternating. When electric drive has been previously advocated, objections have been raised to the danger of explosions due to its use. With a non-sparking type of motor, all wiring installed in pipe conduits, and the switches and fuses placed outside the building, it is hard to believe that any arcing would take place, and if by any chance it should occur that it would be coincident with the presence in the room of an explosive mixture. Objections have also been raised to the use of motors on coal gas exhausters, because of the difficulty in regulation. In at least one plant constant-speed motors have been used for driving the exhausters for some years, and by using a compensator on the gas, the pressure on the hydraulic main has been maintained as uniform as in any steam driven plant. In view of the foregoing, if the use of the electric drive shows a saving, there is no reason why it should not be used. The steam required to be generated to supply the power to operate the electric motors, driving the different apparatus, was estimated as follows:

One of the exhausters would be in use 24 hours a day, for 365 days in the year; the other would be operated at full speed 90 days, and ½ speed 110 days, making 12,240 hours. Six-horse power is required to drive the exhauster at full load, consequently 73,440-horse power hours per year will be used. The consumption of steam per horse power being 36.2 pounds, the annual steam required for this purpose is 2,660,000 pounds. The scrubbers would operate as stated in the foregoing, 13,080 hours in a year, and require 3-horse power per hour, making the steam requirements 1,420,000 pounds per annum.

In calculating the steam required for pumping, the efficiency of the pumps is taken as 2 per cent., which would give a steam consumption of 112 pounds of steam per equivalent of 1 brake horse power delivered for useful work in raising water. The total mechanical efficiency of a combined pump and motor is about 60 per cent., and as the efficiency of the motor is 85 per cent., the power delivered at the end of the engine piston is 85/60 of 2 per cent., or 2.83: as the efficiency of the motor-drive to the end of the motor shaft is 6.2 per cent., then the steam required for motor driven pumps is $\frac{283}{620}$ of that required for individual steam engine drive, or 2,520,000 pounds. As 25 per cent. was added to the power required by coal crushers and coal conveyors to cover loss in belt and gear transmission, which would be saved by motor-drive, the steam consumption would be $\frac{4,380,000 \times 0.75 \times 36.2}{60} = 1,985,000$ pounds. The requirements of the coke handling machinery are calculated in the same manner.

The steam used in the charging machine will be in the proportion that the steam consumption per horse power with motor bears to that with the engine drive, namely $\frac{362}{800}$.

All of the heat of the exhaust steam will be required for heating buildings and holders for 130 days. During the balance of the year at least ¼ of the steam required for ammonia concentration will be furnished from the engine exhaust.

TABLE NO. 3.—*Steam Consumption with Non-Condensing Central Station for Generating Electricity, all Apparatus Operated with Motor-Drive, Exhaust Steam used for Heating Purposes Wherever Available.*

Apparatus: Coal Gas Plant.	Maximum Steam Consumption per Hour in Pounds.	Average Steam Consumption per Hour in Pounds.	Hours per Year in which Apparatus will be Operated.	Yearly Steam Consumption in Pounds.	Boiler Horse Power Required.	Price of Motor Including Foundations and Connections with Machines.	Cost of Steam Connections to Engine.
Three No. 6 Root's exhausters	434	294	8,760	2,660,000	12.7	$970	$205
Two Standard scrubbers	191	162	8,760	1,420,000	5.6	286	205
Pumps for all purposes	384	288	8,760	2,520,000	11.3	810	300
Coal crushers and conveyors	1,100	1,100	1,820	1,980,000	32.0	930	175
Coke conveyor and screens	1,100	1,100	2,190	2,380,000	32.0	663	175
Charging and discharging machines	365	365	2,555	930,000	9.5	1,815	800
Ammonia concentrator	2,400	2,400	1,180	2,840,000	70.0	....	....
Holders and buildings (heating can all be accomplished from exhaust steam)	....	....	....	.....	....	....	....
Condensation and leakage (10 per cent.)	200	200	8,760	1,680,000	5.9	....	....
Totals	....	....	....	16,410,000	179.0	$5,474	$1,860
Apparatus: Carburetted Water Gas Plant.							
Pumps	206	153	5,760	883,000	6.0	1,204	240
Blower	1,800	814	5,760	4,690,000	54.0	1,200	100
Exhauster	217	217	5,760	1,250,000	6.4	660	100
Generator	1,225	1,225	5,760	7,100,000	37.0	....	....
Oil heater	....	....	....	.....	....	....	....
Condensation and leakage (10 per cent.)	239	239	5,760	1,357,000	17.0	....	..
Totals for carburetted water gas plant	....	....	....	15,280,000	120.4	3,064	440
Workshop	360	123	2,200	271,000	10.4	480	100
Condensation and leakage (10 per cent.)	....	....	....	31,000	1.6	....	...
Totals required for workshop	....	....	....	302,000	12.0	480	100
Total boiler horse power for entire plant for all purposes	....	....	....	.....	311.4	....	....
Reserve boiler capacity required	....	....	....	.....	103.6	....	....
Total boiler capacity installed	....	....	....	.....	415.0	6,325	....
300-horse power generating plant	....	....	....	.....	....	26,200	....
Yard connection, high pressure and exhaust steam piping and conduit system	....	....	....	.....	....	....	8,500
Totals	....	....	....	$31,992,000	415.0	$41,543	$10,900

The steam consumption of the motor-driven pumps and exhauster for the carburetted water gas plant is figured in the same manner as that for the same apparatus in the coal gas works. The steam required for the carburetted water gas blower is $\frac{362}{600}$ of that required for the engine drive. The workshop would require 10-horse power in motors, and as in a shop of this nature the average hourly use of the entire connected load does not average over 750 hours per year, the steam required for motor-drive would be $750 \times 10 \times 36.2 = 271{,}000$ pounds.

The engine horse power required was determined by dividing the sum of the maximum hourly demand of steam for motor-drive, as shown in Table No. 3, by 36.2. The quotient is 150. The guarantee continuity of service this should be in duplicate; two engines of 150 horse power each.

Alternating current generators are usually rated for capacity at 90 per cent. power factor, and as the power factor of this plant will probably be not over 75 per cent., the capacity of the generator should be $\frac{90}{75}$ of the engine capacity. All steam requirements in Table No. 3 were calculated in conformity to the foregoing, and all costs of installation are from quotations on material worked out in detail.

This plant would carbonize approximately 48,000 tons of coal per year, and produce 21,600 tons of coke for sale, of which 5 per cent., or 1,080 tons, would be fine dust having no market value, and 10 per cent, or 2,160 tons, would be fine coke having a market value of about $2.50 per ton in the yard, making this fuel worth $5,400. This material mixed would vaporize about 4 pounds of water per pound of fuel under usual operating conditions. The annual boiler room expense of the different plants would be as follows:

TABLE No. 4.

	Plant with Individual Steam Units in which Exhaust is Lost.	Plant with Individual Steam Units in which Exhaust is Utilized.	Plant with Motor-Drive Utilizing Exhaust.
Pounds of steam required per annum	64,073,000	56,116,000	31,992,000
Pounds of steam produced from breeze	25,920,000 38,153,000	25,920,000 30,196,000	25,920,000 6,072,000
Pounds of coal required	5,450,000	4,300,000	870,000
Long tons	2,440	1,920	372
Cost per ton delivered in boiler room	$3.50 8,525	$3.50 6,720	$3.50 1,300
Value of coke burned	5,400	5,400	5,400
Total cost, boiler fuel	13,925	12,120	6,700
Water at 10 cts. per 1,000 gals.	700	605	378
Firemen labor	3,000	3,000	2,000
Supplies and cleaning	500 18,125	500 16,225	275 9,353

The total charges per year against the different plants are shown in Table No. 5.

TABLE No. 5.

	Plant with Individual Steam Units in which Exhaust is Lost.	Plant with Individual Steam Units in which Exhaust is Utilized.	Plant with Motor Drive Exhaust.
Investment for individual motors	$11,392	$11,392	$9,018
Investment for boiler capacity required in each case	10,875	9,375	6,325
Investment for pipe or wire connection	5,915	9,390	10,900
Investment for power house and equipment	....	....	16,200
Total investment for steam supply and motive power	28,182	30,157	52,443
Depreciation	.04	.04	.04
Annual charge for depreciation	1,125	1,206	2,097
Operating charges as shown in Table No. 4	18,125	16,225	9,353
Annual charge for steam supply and motive power	19,250	17,431	11,450

From the foregoing it will be seen that, by an investment of $2,000 for equipment to utilize the exhaust steam to the fullest extent for heating, $1,819 per year will be saved, and that the investment of $22,300, which is the excess in cost of an electrically driven over an engine driven plant, will save $6,872 per annum. If a new plant is being erected so that this saving would be applicable for interest on the difference in cost between the two types, earnings of 31 per cent. are made, but if the plant is already built and the present equipment must be abandoned, causing depreciation to accrue on the cost of both plants, and interest charges on the entire cost of the electric plant, a saving of only 6.8 per cent. on the investment is earned.

In English and European practice gas engines are often used to take the place of individual steam engines on such apparatus as coal and coke handling machinery and the carburetted water gas blower, and occasionally this type of prime mover is used for driving the generators that supply the electricity for the entire plant. No attempt was made to work out figures to show whether there would be any saving by their use, but by calculating the total hours' use of each engine in each year, and using curves prepared about two years ago by the writer from actual quotations and operating costs of both gas engine and steam engine plants, there is apparently no justification for the use of gas engines in any part of this works. This is due to the poor load factor under which the engines would operate, that is to say, the small number of hours that the engine operates at full load during the year, which condition is fatal to economy in gas engine practice, and is also due to the large amount of exhaust steam that can be utilized to advantage for heating and ammonia concentration.

In concluding it might be interesting to note that a coal gas works fully equipped with machinery and electric drive requires a trifle over .12-horse power of boiler capacity per 1,000 cubic feet of maximum daily output, while the same plant, steam driven, requires .2-horse power, and a plant of the same capacity, steam driven, without any labor saving machinery, would require .12-horse power. In a carburetted water gas works a plant designed for motor drive would require .16-horse power, and with engine drive .2-horse power per 1,000 cubic feet of maximum daily capacity.

Discussion.

Mr. Dewey—Mr. Robison's paper contains some figures and deductions that seem incorrect and not to correspond with the usual operating practice. A No. 9 Roots' exhauster, turning over 54 r.p.m. and pumping against a differential pressure of 27 inches and handling coal gas direct from the hydraulic main, will show an indicated horse power of about 11. It would, therefore, not be out of the way to estimate 10-horse power per exhauster, and it would not seem too high to place the steam used per hour per horse power at 60 pounds in a machine of this type. The Holmes' rotary scrubber, capacity 1,500,000 cubic feet per day, will use approximately 3.4-horse power in turning 4 r.p.m., and 60 pounds of steam per horse power hour should be taken for this. Regarding the amount of steam used for the operation of the ammonia concentrator, no account was taken in the figures given of the lime water or pumps necessarily a part of the concentrator. We have made some tests on a 6-foot concentrator running something over 1,000 gallons of 1.8 per cent. crude liquor per hour, and find that the steam consumption for concentrating the liquor from 2,000 pounds of coal will run about 170 pounds. Therefore, I would revise Table No. 1 as follows:

Apparatus: Coal Gas Plant.	Steam Consumption per Hour in Pounds. Maximum.	Steam Consumption per Hour in Pounds. Average.	Hours per Year in which Apparatus will be Operated.	Yearly Steam Consumption.
Three exhausters, 1,000,000 cubic feet daily capacity each	....	....	....	8,136,000
Two standard scrubbers	....	....	....	4,891,920
Pumps for all purposes	1,000	625	8,760	5,475,000
Coal crushers and conveyors	2,400	2,409	1,820	4,380,000
Coke conveyors and screens	2,400	2,400	2,190	5,250,000
Charging and discharging machines	800	800	2,555	2,050,000
Ammonia concentrator, 170 lbs. per ton (2,000 lbs.)	2,400	2,400	1,675	8,160,000
Holders (heating)	1,500	750	3,120	2,340,000
Buildings (heating)	800	400	3,120	1,250,000
Works water pump	....	....	....	8,660,000
Heating tar tanks	....	....	....	5,000,000
Condensation and leakage (10 per cent.)	440	440	8,760	5,512,920
Total for coal gas plant	...	....	....	61,105,840
Apparatus: Carburetted Water Gas Plant.				
Pumps	360	360	5,760	1,920,000
Blower engine	....	....	....	8,064,000
Exhauster engine	....	....	....	3,478,000
Generator	....	....	....	9,600,000
Oil heater	170	170	5,760	960,000
Condensation and leakage (10 per cent.)	....	....	....	2,421,200
Total	....	....	....	26,443,200
Workshop	600	400	2,200	880,000
Condensation and leakage (10 per cent.)	....	....	....	110,000
Total	....	....	....	990,000
Grand total	....	....	....	88,539,040

You will note I have figured, in calculating the steam consumption for the exhausters (first item, Table No. 1) 10-horse power × 60 (steam consumption per hour) × 13,560 (total hours of operation for both exhausters). The same applies to the scrubbers. Under carburetted water gas plant I have taken 35-horse power as the necessary horse power for operating the blower engine and the steam consumption for this engine should not exceed 40 pounds, as it is run at about full load and is a high speed engine and should be equipped with a fly-wheel governor. Steam used in the generator I have materially changed, ordinary practice demands about 36 to 40 pounds steam consumption per 1,000 feet of gas made when coke is used. This means a total annual steam consumption for both coal gas and water gas plants of 88,539,040 pounds, which is about 24,000,000 pounds more than Mr. Robison has given in his paper. In figuring up steam consumption (Table No. 3) using the electric drive, only 6-horse power has been taken to drive the exhausters. Just why it will take less horse power with the motor drive than steam drive is not clear. Driving the exhausters with motor, as is proposed to do, demands that the power required at the maximum load must be operated continuously. Inasmuch as the peak load will run from 15 to 20 per cent. above the average, it would mean that that much greater power would be required throughout the entire period. I have, however, taken 10-horse power per exhauster. Table No. 3 should be changed as follows:

Apparatus: Coal Gas Plant.	Steam Consumption per Hour in Pounds. Maximum.	Average.	Hours per Year in which Apparatus will be Operated.	Yearly Steam Consumption.
Three No. 6 Roots exhausters	434	294	....	4,881,600
Two standard scrubbers	....	....	....	1,644,320
Pumps for all purposes	384	288	8,760	2,520,000
Coal crushers and conveyors	1,100	1,100	1,820	1,980,000
Coke conveyors and screens	1,100	1,100	2,190	2,380,000
Charging and discharging machines	365	365	2,555	930,000
Ammonia concentrator	2,400	2,400	1,180	8,660,000
Heating tar tank	....	....	....	5,000,000
Condensation and leakage (10 per cent.)	200	200	8,760	2,749,592
Total for coal gas	....	....	....	30,745,512
Apparatus: Carburetted Water Gas Plant.				
Pumps	206	153	5,760	883,000
Blower	1,800	814	5,760	7,317,920
Exhauster	217	217	5,760	2,073,600
Generator	1,225	1,225	5,760	9,600,000
Condensation and leakage	239	239	5,760	2,000,000
Total for carburetted water gas plant	....	....	....	21,874,520
Workshop	360	123	2,200	271,000
Condensation and leakage	....	....	....	31,000
Total required for workshop	....	.. .	....	302,000
Totals	....	....	....	52,922,032

This makes a total of 52,922,000 pounds steam consumption with electric driven motors. This would materially alter the calculations throughout the paper and necessarily reduce the percentage of savings, although the total reduction in the amount of steam used per annum would be about the same. An interesting sidelight on the amount of steam required to actually operate a plant compared with the amount required in the hypothetical one taken in the paper, for the year 1908, is as follows:

Total coal gas made	473,364,000 cubic feet.
Water gas made	298,168,000 "
Total	771,532,000 cubic feet.

The total steam consumption, figuring back from the coal used and taking the evaporation as 8 pounds for coal, and 5 pounds for coke, gives us 88,400,000 pounds, or 115 pounds of steam per 1,000 feet of gas made. This coal gas plant has charging and discharging machines, coal handling apparatus, coke elevators, ammonia concentrators, etc. It is in most every way a modern type of coal gas and water gas plant. There are, however, nothing but simple non-condensing engines throughout the plant. You will note that it checks very closely with the figures I have given in the revised tables, the steam consumption being about 117 pounds per 1,000 feet of gas made.

Mr. Klumpp—Mr. Chairman, I think some of the figures in this paper that Mr. Robison has assumed on steam consumption are very low, and I agree with Mr. Dewey. He cannot get below 60 or 70 pounds of steam per kw. hour, if he is going to put in an electric driven plant. I see no reason why we cannot adopt a gas engine. At holder cost for the gas used he would realize great economies. He speaks of the practice in the past of not using gas engines. Of course, if he was talking of installing half a dozen small gas engines in various parts of the works, he would not get these economies, but with a single large unit it should be considered, within the last 5 years, gas engines have been greatly improved, and if anyone is considering putting in an electric driven plant, by all means figure also on gas engines, because you can get economies with your gas—at holder cost. It has been said by some persons who put in gas engines that their repairs have been very high, in the past. This may be so, but gas engine repairs to-day are getting as low as steam engine repairs, and the gas engine is just as reliable.

Mr. McKay—In Table No. 1, for water gas manufacture, the largest single item of steam consumption is driving the blower, which figures out at 32 pounds per 1,000 feet of gas made. Perhaps the author considered a volumetric blower in that estimate. Our experience with blowers is that probably not more than 11 or 12 pounds of steam per 1,000 feet of gas made need be used in blowing air through the generators, and I speak of this in order to emphasize the possible economy that may result from substituting the positive type for the volumetric type of blower.

Mr. Brown—Commenting on Mr. Dewey's discussion, I think he would be the last one to say that he would put a 10-horse power engine on an exhauster. I think, when we are considering the average working conditions, in works of that size, we must figure that the man who is wise in putting in the ordinary solid-valve type of engine would make it big enough, so that while his steam pressure might be assumed at 125 pounds he would be able to operate at 80 pounds. If he did not he would perhaps gain a theoretical economy by putting in an engine just big enough to operate, but he would lose in reliability. I do not think any of us would choose between the two; we would gain reliability at whatever the cost. On the question of steam consumption, I think, if we took actual tests in a great many works of this size that we know of, we would find Mr. Robison's figures under rather than over. I realize there is a great deal in what Capt. McKay said as to the possibilities of economy through using positive blowers, but in the past it has been a pretty difficult thing to use them, because of the great relative differences in discharge required to operate water gas machinery. I think Capt. McKay might have added that the way he has been able to use positive blowers is through a special form of governor which they have developed, with which perhaps the rest of us are not familiar.

Mr. Bates—I am not sure whether the author concludes that the use of 25-cycle, 3-phase motors is desirable or not, but I think it is very essential that that should be given careful consideration. While it is true that the 25-cycle motor is a low speed motor, a small 25-cycle generator is difficult to obtain. A 60 cycle can be readily obtained from your electric light man for breakdown service. I think also there is some doubt as to whether 3-phase should always be taken. It may well be that 2-phase is desirable for the same reason. As far as 25-cycle lighting is concerned that is at present good enough. As you know, there are many thousand incandescent lamps of 25 cycles used in Buffalo, and the elevated stations in New York are all so lighted.

The Chairman—Mr. Robison, will you close the discussion?

Mr. Robison—As to the size of the exhauster engines, I figured out the actual horse power that would be required, and figured on 12½-horse power engines, with a steam consumption of 100 pounds. As to the gas engine suggested in the paper, I did not try to work out at this particular time the possible economies in this kind of prime mover, but some time ago, when I did work it out pretty carefully, I found the estimate of operating at less than 50 per cent. of the load factor, and the high cost of the engine did not make it look very promising. I intended to work that out in more detail, but the paper became too long and I did not go into it. Regarding criticism of the cycles used, I considered the possibility of buying current from the local electric light company having a breakdown connection, and the possibilities of using the 60-cycle, 2-phase current, but my own experience, and considerable talk with men who have devoted all their time to that particular branch of the business, led me to believe that, for the reasons given in the paper, the large size of the 60-cycle motors, as compared with the 25-cycle, and the difficulty of getting a variable speed on the 2-phase, 60-cycle, led me to recommend the use of the type of current that I did.

MORNING SESSION, OCTOBER 21ST, 1909.—COMMERCIAL SECTION.

The meeting of the Commercial Section was called to order by the Vice-President, Donald McDonald, of Louisville, who appointed Mr. Clabaugh Secretary of this meeting.

Mr. George W. Thomson then read his paper on

GAS IN THE MODERN KITCHEN.

To install successful modern kitchens, a study of local conditions is essential. The most important is the amount of fire carried in the firebox of the furnace, as on this depends somewhat the location of the proposed coil as well as the success of the equipment. To maintain the kitchen at a temperature of 70° in zero weather, by means of a coil in furnace, requires the upkeep of an average furnace fire, which does not mean that you would have to use additional coal on account of the coil; but both heat and hot water cannot be guaranteed where only slow or small fires are run. In many cases, though, the coil in slow fires will supply the hot water for domestic purposes, and to secure heat for the kitchen in such cases an extension of the original heating system is required or else a little more fire must be carried. This is particularly true of hot water heating plants. For the occupant of the house to obtain results from our installation, he must be willing to help the Company in its efforts, by maintaining good fires, removing ashes, clinkers, etc., from around the loop, as some slight extra attention *is* necessary to successful operation.

In making estimates for a kitchen heating system, the inspector should, first, carefully inspect the kitchen, taking note of its constructions and exposure and govern himself accordingly. A poorly constructed kitchen with loose windows and doors, will, of course, require more radiation than one well built, and due allowance should be made. Each job should be one that will be the means of securing others. The following rule will be found approximately correct and safe under ordinary conditions:

Having first ascertained the dimensions of the room, find the number of square feet of glass surface in the windows and outside doors, figuring these doors as if glass, and measuring the entire opening of windows and door frames. Ascertain the square feet of exposed wall surface, from which deduct the glass surface as obtained above, and this will be the net amount of wall exposure. Then reduce the wall surface to the equivalent of glass surface by dividing the net amount of wall exposure by 10. This result, added to the glass exposure, gives the glass equivalent of the glass and wall exposure. Multiply this glass equivalent by 75 (the cubic feet of air that each square foot of glass will cool per hour) and the product is the cubic feet of air to be heated to overcome the cooling effect of the glass and wall exposure. Now add to this the cubic contents of the room, and we have the total quantity of air to be heated.

It is customary to guarantee a temperature of 70° in zero weather. To arrive at the amount of radiation under this guarantee, multiply the quantity of air to be heated by the decimals given below, and the product will give the number of feet required.

In localities where the temperature falls below zero, add to the amount of radiation obtained 1 per cent. for every degree below zero.

For temperature of water in radiators.....	160° × .0092
" " " " " "	170° × .0081
" " " " " "	180° × .0072

For water we recommend using the multiple .0092; for if water is 175° in flow and 145° in return, the average is 160° in radiation.

The foregoing rule is based upon using direct radiation, and the apportionment provides for one change of air in the room per hour.

For more frequent changes increase the cubic contents by as many times as it is desired to change the air per hour, but the multipliers remain the same.

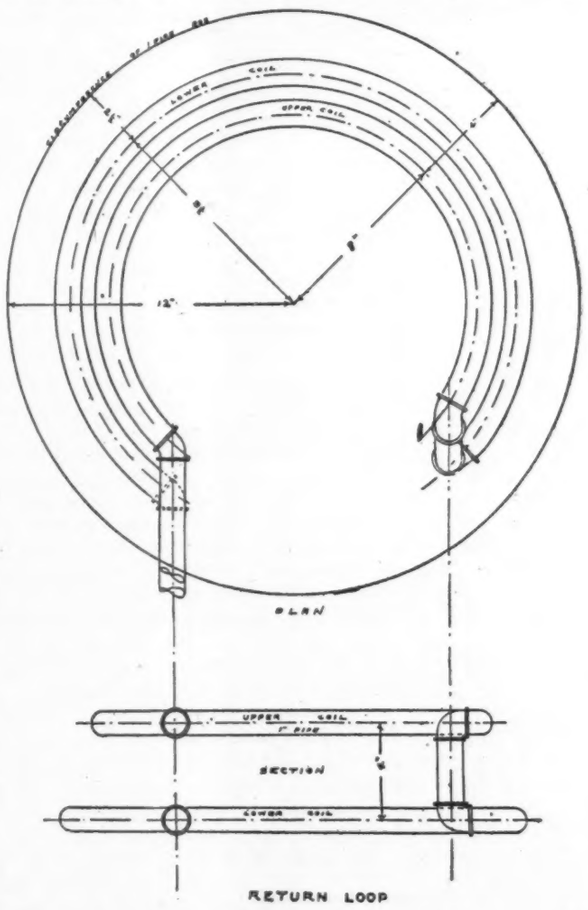
Example.—Room, 16 feet wide, 20 feet long, 10 feet high; 4 windows, 3 feet wide, 5 feet high; two sides of room exposed to zero waather; 10-inch thickness of wall; 16 × 20 × 10 = 3,200 cubic feet of air in room; 3 × 5 × 4 = 60 square feet of glass in windows; (16 + 20) × 10 = 360 square feet of wall surface exposed, including glass; 360 — 60 (glass) = 300 square feet actual amount of exposed wall surface; 300 ÷ 10 = 30 = glass equivalent in wall exposure; (30 + 60) × 75 = 6,750 = air in cubic feet cooled by windows and walls; 3,200 + 6,750 = 9,950 = total in cubic feet of air to be heated; 9,950 × .0081 (multiplier for hot water) = 80.5950 radiation in square feet required to heat room.

The above rule is taken from The Model Heating Company, Philadelphia, Pa.

The Inspector should, by measurements figure out the amount of radiation required, length of run, kind and size of furnace, etc. With this information we are able to determine the amount and size of pipe to be used in making our loop or water-back for firebox in the furnace and whether the installation is practical for us to undertake or whether we should refer it to a plumber.

We have found the rule allowing 1 square foot of pipe in furnace for each 32 feet of radiation is not always practical on account of fire conditions; for illustration: Take two houses in same row with same kind of furnace and kitchen; the results obtained from same amount of coil will widely differ, due entirely to the operator of the furnace fire.

To secure the best coil or water-back we have tested many water-backs now on the market, also many home-made ones; the efficiency of each varied according to local conditions, amount of radiation, kind of furnace, fire, etc. Our best results have been obtained by a return loop designed by our Mr. Savage. It takes up less room and



is not in way of operator of the furnace when cleaning or regulating his fire. When required, we can get most furnaces, as high as 3 square feet of heating surface without deadening the fire. This loop is made in our shop of 1-inch galvanized pipe of proper length, two 1-inch ells and a short nipple; the bend is on the order of a double hook, the radius of the upper pipe being a trifle less than the lower pipe; the opening of the hook leaving free access to the furnace pot.

Our runs from bottom of kitchen hot water boiler to loop in furnace and return to hot water inlet of boiler, are made in three sizes, ¾ inch, 1 and 1¼-inch galvanized pipe, depending on length of run and circulation required. In a few cases, we find it advisable to cover these runs so as to prevent loss by radiation before radiator or boiler are reached, with asbestos or mineral wool covering. If the floor of the kitchen is exposed to the ground, by all means use some kind of covering.

We are using wall radiators, having found them not only to be the most efficient when compared with loop and pipe coil radiators, but easier to handle, neater in appearance, requiring much less space, and they cost much less. They can be assembled vertically, horizontally or as a plate warmer and are furnished in sizes from 4 to 9 square feet per section, costing about 21½ cents per square foot.

Plate Warmer.—All piping and radiators exposed in kitchen are painted aluminum; this, with floor collars, leaves the work pleasing in appearance, not only to owners, but to their friends. When one installs a modern kitchen, he is bound to show the same, therefore the impression created depends on the general appearance and results obtained.

Plate Warmer.

The coke burner or kitchen heater is being used in a number of cities to further the use of gas ranges in houses that have no furnaces, with good results. We have made several tests of these coke burners, finding the drawback to their sale to be the first cost. Houses that have no furnaces are those that rent for about $12 per month and the tenants of this class of house cannot pay $15 to $18 for a coke heater. In many cases a small base burning stove is much easier sold and the results are the same. I have found many occupants of such houses using a coal heating stove in dining or sitting room, and when door is left open between kitchen and sitting room they obtain a good working temperature. The majority of such kitchens are small and easily heated.

We want a kitchen heater or coke burner that will be within the reach of all houses. Many are now only using their gas range 3 or 4 months in summer because of no economical means of heating kitchen in cool weather. There is no doubt that such an appliance will have a large sale and would double, yes triple, our present gas sales in these houses. The winter cooking is much more elaborate than in summer, more fuel being required to do the work. Now, why not get this business?

Another problem which confronts us is the rented house with hot air heating. The kitchens in most of these houses can be heated by extending the hot air flue, costing about $6, which many tenants will pay themselves. These extensions have proven very satisfactory and are very easily installed. This makes a modern kitchen, all cooking and water heating being done by gas at a saving over the former coal range.

In cities where the sale of gas ranges has been well introduced it means that many of the future range sales will be renewals, which does not mean increased gas sales in every case; therefore, to obtain all-year-round cooking, we should devote our efforts and range advertising to the abolishment of the coal stove entirely and get an increased use of gas on these renewals as well as on our present investment.

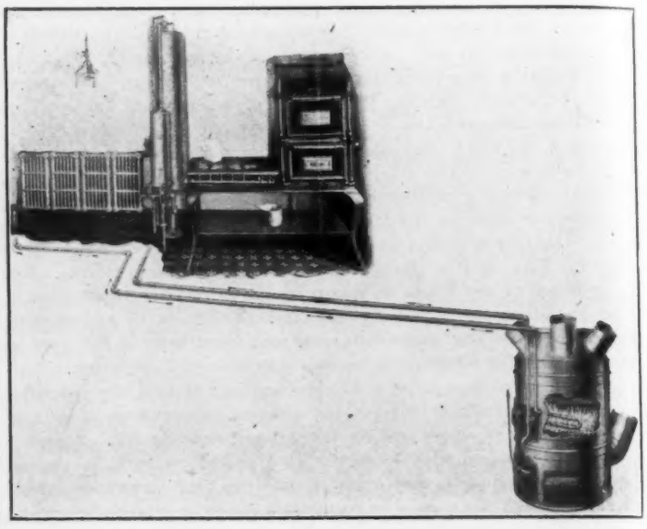
When warmer weather arrives and furnace is out of use, then to heat water satisfactorily is a problem to many householders. To maintain a constant supply of hot water at faucets through the house requires the installation of one of the many satisfactory automatic water heaters. For convenience, storage, or straight automatic water heaters of proper size are giving general satisfaction day and night and at a small cost per gallon of water heated. These are connected either by the direct or reheating system.

I inspected several large building operations in an Eastern city that are equipped with direct furnace heat, hot water being supplied by coil in winter and automatic water heater when furnace is out. When furnace fire is low, valves are opened and the partly heated water from coil is brought to the required temperature by passing through the automatic heater

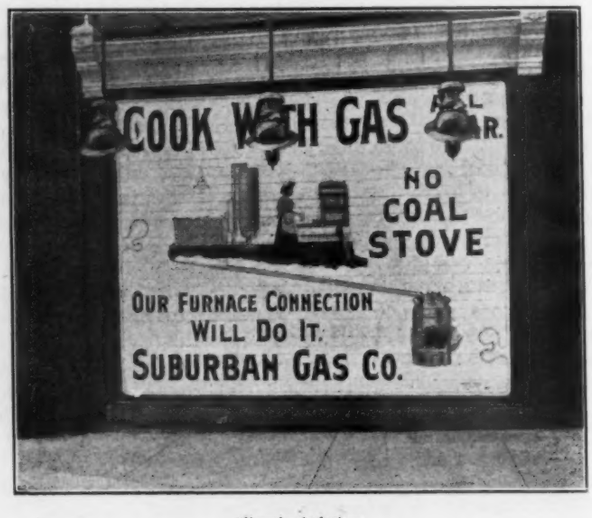
When using circulating heaters connected to hot water boiler we set the burners to pass about the following gas: No. 1 heater, 38 feet per hour; No. 2 heater, 53 feet per hour, each heater being connected with a flue which helps to increase the efficiency. Our experience has proven that the larger heater will be used more on account of the quicker results. Our aim should be for quick results with the highest efficiency possible.

The cooking range in the modern kitchen of the new houses should be the cabinet type of gas range. A number of these ranges have 22-inch auxiliary ovens and 6 top burners. In a few cases 6-foot hotel ranges are being used in houses where there is considerable entertaining. Many of these ranges have been furnished with high shelves, hoods and flue connections. These and the necessary small gas appliances give you a modern kitchen, but not an elaborate one. There is a demand for a gas range that will compete with the best of coal ranges as to construction for the more elaborate homes that are being built throughout the country.

Modern Kitchen.—Our work this year (which has been a record breaker in gas appliance sales) has been largely devoted to bringing about the increased use of gas in the kitchen, by conducting an aggressive advertising and soliciting campaign throughout the year on the modern kitchen.



Modern Kitchen.



Illuminated Sign.

Another means of advertising is to mail to our present modern kitchen users a return postal card, worded as follows, with the average answers given:

"A reply on the attached card to these questions will be greatly appreciated, as will a notice of any way in which we can improve your service."

No. 1. How long have you used gas for cooking in both winter and summer?

A. About 2 years.

No. 2. Do you find it more convenient than the use of a coal stove?

A. Yes, most decidedly.

No. 3. Do you find it more economical?

A. Yes.

No. 4. How many hours per week do you use your gas range?

A. About 30 hours.

No. 5. About what is the difference per month between the cost of gas used in your gas range and coal used in your discarded coal stove?

A. About $1 to $2 per month in favor of gas.

No. 6. By what system is your kitchen heated?

A. Furnace coil—some extensions.

No. 7. Do you object to the use of your name in connection with the above questions?

A. Do not.

Out of all postals returned there was not a single complaint, all being good.

We also sent out another such card to the contractors and architects, and give the average answers to the questions.

To Contractors and Architects.

Q. Are your customers, who have rented or bought the houses that you have equipped with all-year-round gas ranges satisfied with their operation and the cost of same?

A. Yes.

Q. Have these installations given you much trouble for repairs?

A. No.

Q. What have been the criticisms of this equipment from your customers?

A. Good.

Q. Do you consider this scheme a good one, or advantageous to the builder? If so, along what lines and to what lines and to what extent?

A. Yes, it is the coming kitchen.

Q. Does it give you additional selling points?

A. Yes.

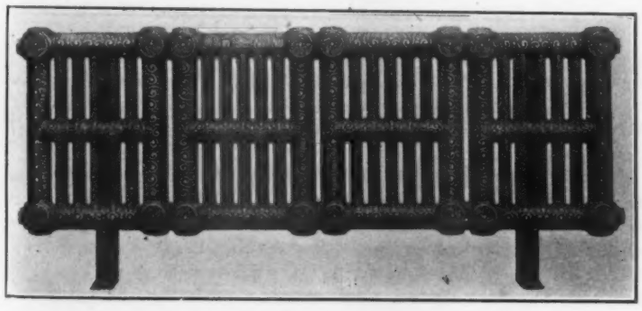
Q. Is it entirely practical for domestic purposes after the public has become educated to the value and desirability of its use?

A. Yes.

Q. Does it please the men of the house or just the women?

A. Both.

These cards are used for several advertising schemes; at present, they are used in connection with our window display made up with a complete kitchen outfit using a kitchen cabinet, cabinet gas range, water heater and boiler, wall radiator, etc. The postals are tacked



Wall Radiator.

on a large board and occupy a prominent place so as to be readable from the street.

The present system of using the gas range for summer cooking only is so grafted on the most of our consumers that it will take considerable discussion and educational work to effect a change, but it can be done.

A meeting is held each Saturday morning for the schooling of our business builders, but as these meetings take in all gas appliances, I will only tell of a part devoted to the increased use of gas in the kitchen. The first lesson takes up the principles upon which a new business department is founded and upon what depends its future success. Papers are prepared in advance on the successful operation of gas kitchen appliances, such as gas ranges, water heaters, toasters, gas irons, etc. As only one subject is taken up at a meeting, this gives each man a chance to write on one of the many domestic gas appliances. An imaginary sale of some modern kitchen appliance is often arranged between two solicitors. This has been very helpful in the training of our men, as it enables them to meet all objections offered by a real prospect, and the arguments are very instructive; the men get very enthusiastic in their effort to overcome the other fellow's objection.

We are able to make a small profit by putting our selling price at $22.50 for a furnace connection of 27 square feet of radiation and 30 cents for each additional square foot required, and trying not to undersell but co-operate with the local plumbers. Where sold in connection with a water heater, the price is $35, or $2.50 less than when sold separately. For installing coil, less radiation, we charge $15.

Two hundred moder kitchens, picked out at random, show an average of 52,000 cubic feet of gas per year, showing that if every house had a modern kitchen our annual sales would be almost double what they now are. The pushing of the modern kitchen could be helped by the gas companies combining for the purpose of advertising in several national home papers, such as the *Delineator*, *Ladies' Home Journal* and a good magazine. All of this additional business is on *present mains and services.*

Discussion.

The Chairman—You have listened to a very interesting paper. It is evident that a small meeting of men intensely interested in a subject will be better able to do justice to it than a larger meeting where there is not so much interest. I assume that you are all interested in this subject, as it promises an immense increase in the output with very little added expense. I am now going to leave the subject open for discussion.

Mr. Clabaugh—This is one of the most interesting papers I have listened to for a long time, because for the last 19 years I have been talking about furnace connections. In Omaha we put in the first one I had ever heard of. We started in using a ¾-inch pipe, making a return in the furnace. In the beginning this was very satisfactory, but after using it for some time we found the pipe would soon fill up with Missouri river water sediment. We then took a 3-inch nipple, and in that nipple ran a small pipe down to within 2 inches of the bottom; the nipple was about 9 inches long; in the top of that was a ¾-inch hot water return. This was placed down in the furnace, and it was very satisfuctory as far as we had gone; but it had the objection of being too large for a small furnace, and of throwing the fire to one side. We also used the Acorn heater. This was supposed to be made with a very thin bottom, but they thought to improve upon it by adding what was called a clean-out, by putting a nut on the bottom, which was utterly impossible to take off after it had become heated a long time. We were not satisfied with this heater because all the sediment gathered at the bottom and remained there. We finally adopted a 1¼-inch return, and I think if Mr. Thomson will run that size return he will get very much better results and the pipe he will find will need much less cleaning. In Omaha almost every house has a furnace connection. We make very few of them ourselves to-day. There is not a house built or a furnace put up that has not specifications calling for furnace connection with the kitchen. A great many of the boilers are put down in the basement, near the furnace, and they have an auxiliary heater for the kitchen connected with the hot air furnace or with the steam system. The architects understand this perfectly, and there are no houses built now without the furnace connection. Our gas stoves are not taken out in the winter time; with very few exceptions they burn all the year, owing entirely to this winter coil in the furnace. Mr. Thomson has suggested the coke heater in the kitchen. I would suggest for the coke heater the putting of a little coil around the side. We have tried that in a number of cases. It has given hot water easily and will keep the coal range out of use. I know of one locality in which there were six 3-family houses built, and in which there was only one coal range, and that has been taken to the basement. We feel there has been nothing in our business that has increased our output more than this furnace connection. It appeals to everyone, because they have hot water, and they can keep the gas range in use. When this was first done people would say: "We do not understand this; we do not believe the Gas Company wants to give anything away, and there must be some ulterior motive behind the proposition. We have a gas hot water heater and it is perfectly satisfactory; why do you want to cut it out?" I told them there was no ulterior motive whatever, except for their and our good. We knew positively that, with the extreme cold weather we have in Omaha, the gas range would have been taken out and the coal range supplant it, if it had not been for our proposition, and, therefore, we were willing to lose the sale of that amount of gas in order to keep out the coal range, on the principle that we would rather have a half loaf than none at all. It appeals to people. I think the average cost of the equipment was $6.90. We do not cover our pipes. I think it is a good idea to cover them, but as a rule you will find that, where there is a furnace in the cellar, it is practically the hottest place in the house unless the furnace is covered with asbestos. I know of nothing that will increase the output more than this furnace connection, and I feel particularly glad that the gas men of the country are looking into this subject. I have talked it for the last 15 years, and I cannot say too much in its favor.

Mr. Pettes—I have one of these furnace connections in my house in East Orange, and if I could not get another one I would not take $1,000 for it. There is nothing else that has given better satisfaction. We get hot water and plenty of it. We have no radiator in the kitchen. The kitchen, which is of modern size and modernly equipped, gets all necessary heat from the hot water boiler. In summer we use a Ruud heater. During the whole year there is not a pound of coal used in my house for cooking. I would like to ask Mr. Clabaugh if the heaters in Omaha are principally hot air or steam. We found a great deal of difficulty in our territory in getting connections into some of the steam heaters.

Mr. Clabaugh—In answer to Mr. Pettes I will say the majority of the heaters with us are hot air heaters. There are a number of steam heaters on some of which we have been unable to put the coil. I suggest putting the coil in the flue pipe where there is certainly a great deal of heat passing up the chimney at all times that would keep the water hot. I think a connection could be made there which would be very satisfactory.

Mr. Hanlon—I wish to compliment Mr. Thomson on the excellence of his paper. Our company has made an aggressive campaign for this class of business for the past 5 or 6 years. As a result we have reaped a harvest and we are getting it more and more every day. We are going a little further now in the city and suburban houses, and are getting the builders to place radiators in the kitchen, and this past season has been one of our best seasons so far. We have done the largest business just through this modern idea of getting people interested in using gas for cooking all the year round, instead of as formerly for only 2 or 3 months. You would be surprised to see how the idea has taken among our consumers. A large number of houses that were considered impossible to reach a few years ago are putting in gas ranges now. They are not leaving out the coal range, but wherever a house is steam heated we manage to get in an installation of a gas range and gas water heater; and if the house is large enough we install generally an automatic water heater as well, leaving out the boiler entirely. We are preparing now a book which we propose to issue to architects and builders, and also to mail to every prospective builder or owner of a home, that we think will help this work along. We have made arrangements with a company that operates in New Jersey that furnishes us with reports, and by that method we get advance information from the architects whenever a house is contemplated, long before the permit is issued and before the record is placed with the city or town authorities. We have men especially detailed for this class of work and the results have far exceeded our expectations.

Mr. C. W. Hare—It is safe to say that 60 per cent. of our consumers would prefer, without any solicitation, to use gas for cooking throughout the year, the only question in their minds having been how they should heat the kitchen in the winter time. Consider this a moment. A large majority of your consumers want to use, roughly, twice as much of your product for fuel as you are now supplying them. We all say we want them to use it, but are we all doing anything definite to secure the result? Several methods have been tried and those mentioned by Mr. Thomson in his very able paper have proven successful. If we want the public to adopt these methods we must advertise them. We all talk about them in our offices and we agree that it is a good proposition for us to have our consumers use gas for fuel in winter time, but that won't get the public to use it. You cannot expect a solicitor to instantly convince the entire public that we have what it wants. This is one instance where newspaper advertising and circularizing will produce good results in paving the way for your solicitor. The coke heater referred to by Mr. Thomson in his able paper answers the requirements in some instances. Show it on your sales floor; advertise it; impress upon the solicitor the necessity of talking about it. The coil in the furnace, connected to the kitchen boiler for the supply of hot water, the kitchen being heated by a radiator on this connection or by a hot air flue or steam radiator connection from the furnace or steam boiler, is really the ideal installation. Get in touch with the architects and builders in your territory and let them know the advantages of it. Arrange your prices so that they make the arrangement an attractive proposition. The first cost is what the builder, with houses to sell, looks at, to a very large extent. When you have educated the public to expect a modern kitchen it will not be necessary for you to figure so close. Try to get the coils installed in old houses. To make a success of this I believe the gas company should undertake the work of installation. The main point is to let the public know they can use gas for fuel throughout the year and have a comfortable kitchen in the winter time, and hot water. The results you want will follow.

Mr. Rogers—I think we have to contend with the same conditions that Mr. Thomson speaks of. We have a manufacturing city (Paterson) and what concerns us most is how to increase the consumption among the wage earners. In our town the better classes of houses are universally steam heated. We have a great many 2-family houses in which each of the two apartments has a separate steam heating plant, and, of course, in those houses gas is used for cooking all the year round. We have had some houses built without a chimney to the kitchen. I know I had to hustle to get a man to put the service in a house of that kind because the people couldn't get anything to eat until they got their gas connected; but the majority of our population is employed in the silk and other textile mills. Some of them make good wages above the average, and are good people, but they usually live 3 families in each house, that is, 1 family on each floor of the 3 stories. I have tried to get such people who use coal ranges to use these newer methods and we have tried to figure some means of making a smaller boiler with a gas water heater but the expense has always been too great. I would like to ask if Mr. Thomson has any suggestions as to how we could encourage these people to throw away their coal ranges altogether and use gas all the year round.

The Chair—Mr. Thomson will close the discussion and answer all those questions at once. Any further discussion?

Mr. Eavenson—I would like to know the material used in the coil, and I would ask the gentleman who uses the 1¼-inch coil whether he has been successful; we have used them with very excellent results. Is the coil bent to take the curve of the firepot, or does it extend through the firepot? I would like also to ask about the shape of the coil and the material.

Mr. Thomson—In reply to Mr. Rogers' question about small houses, we have taken care of some by putting in a small coal heating stove. Others we have let go until we can get a satisfactory coke heater. Houses that have no furnace are generally occupied by tenants that cannot afford big prices for appliances, and for that reason we have been devoting most of our efforts to larger houses costing from $3,000 up. In regard to the material of the pipe, we are using wrought iron; I would not say that it is not steel, but it is supposed to be wrought iron. We are making tests with brass and copper. I am afraid we will have to return to the wrought iron pipe. We have installed over 400 furnace connections in 1½ years. The newer and suburban houses are being taken care of by the builders. We have our shop busy now with the old houses.

Mr. Searle—In order to make this furnace connection popular and cheapen its use it seems necessary to have skilled men to follow it up and keep it working. Rochester has put 3,000 in use in the past two years. As to the price, we started first with $5, then to $12.50, and up to $20. We have 8 plumbers doing this work and send an expert to supervise each installation. We have found, as Mr. Thomson remarked, almost every installation is a distinct case of its own. We have tried the brass and copper connections and these have overcome the more common difficulties. In Rochester we have 7½ months of heating, which means that the gas range has very little use in 1 month, a little bit more during 2 months, and for 3 months is used practically at its capacity. This furnace connection brings the gas range to its maximum use every day in the year. Cooking in winter means heating very cold water; that means a lot of gas; it means boiling vegetables that are almost frozen; that means a lot of gas; and, looking at it comparatively, it means 18,000 feet in Rochester when a stove is used for the 5 summer months, and 40,000 feet when used all the year with a furnace connection. So you can well afford to put in your furnace connection. I am now referring to gas consumption of a range only. It gives you something like 122 per cent. increase.

Mr. Prichard—I would like to emphasize the point that has been made in regard to the stopping up of the wrought iron pipe. I have tried putting the wrought iron bend in the furnace, and found at the end of two years that it was absolutely stopped up, and I think if it had not been attended to there might have been serious results. Since that time we have always recommended a brass coil; the pipe can be put in through the furnace door and made inexpensive. We have had good results in putting in these little hanging devices that hang over the firepot in the center of the furnace, and use a radiator in the kitchen, which gives the kitchen all the heat necessary. The people in the house forget they ever had a coal stove. In other houses where we have been unable to do this we put in a gas stove with coke heat-

ing side attachment, and have found those extremely successful, because they start quickly, and if they die out they can be lighted easily, and many of those have the coil in also. Then, as an auxiliary to that, we have always advocated putting in a small $6 or $8 heater connected to the top of the kitchen boiler, and the combination of the 3, or any 2 out of the 3, has so far hit any case we have come upon. We have many cases, such as the gentleman refers to, of people who are not very large wage earners, and many of them are families of 1, 2 or 3 persons, who all work in the shops and go to work at an early hour, but we find it is an easy matter to get these people to use gas in the kitchen, because they like to sleep in the morning until the last possible moment, and if they have a gas stove with hot water attachment, they can get their hot water ready as quick as they can get their clothes on and soon have their breakfast.

Mr. Pettes—I would like to ask Mr. Clabaugh as to the coil in the flue pipe. I have tried the loop around the furnace, the loop across the furnace, and also the Acorn. I like the loop across the fire the best. And as far as stopping up is concerned, I looked after that in my own house. This was done as an experiment, as an argument either in favor of it or against it. I had an Acorn in service for 2 years; I took it off, sawed it in two, and I found there was no deposit in it at all, when I fully expected there would be.

The Chair—Your town has good water?

Mr. Pettes—Yes.

Mr. Clabaugh—In answer to Mr. Pettes' question, you will remember this coil in flue pipe was suggested to me yesterday. I have never tried it, but it seems to me it might be used where we could not get into the furnace pot. Now, as we use the furnace connections, the pipe goes in the side of the door straight across the furnace, with an elbow. We have very little trouble with stoppages, although we do have some. The furnace connection will run all right for 4 years, at the end of that time it will probably take 20 minutes to clean out the hot water pipe where it enters the boiler. That is the place it generally stops up. I do not believe it will be necessary to use brass coils even in Omana. I think the additional cost will be very much against it. We connect the circulating water heater for $10 and make a profit on it. We are doing very little of that work ourselves now. It appears now, in the specifications of every plumber in town; in fact almost every furnace that is sold must have an opening in that furnace for the coil. So we have the people interested. It is a thing that has been advertised so extensively for the last 18 years that everybody knows what it is.

The Chairman—I do not hear any conflict of opinion as to the merits of this thing. I would like to hear some discussion as to which is the better; the coil in the furnace or the other?

Mr. Pettes—In our judgment the coil in the furnace is the best proposition. We want heat in the kitchen, and also want a supply of hot water, not only in winter but in the summer time. By means of this furnace connection we can give them hot water with very little additional cost in the winter time. In most instances, in Jersey City, where I am familiar with this proposition, it is not necessary to put a radiator in the kitchen. The heat from the boiler in the kitchen is enough. I have in mind an instance that might be of interest. We put an Acorn plug in a furnace in Jersey City and heated 2 boilers and 2 radiators from that furnace. That was 3 years ago and it was a very cold winter. I went around there during that winter several times and the party was thoroughly satisfied. Every room was cozy which that heater furnished and they were getting plenty of hot water both from the downstairs boiler and the upstairs boiler. We have no trouble whatever with stoppages in the heater. We also use galvanized iron pipe, 1¼ to 1½-inch. The former I believe is right. We have had no trouble with it. We use the clean out cock, but for another purpose, and that is to have a little hose pipe connected with it so that we can fill the hot water reservoir in the furnace, and also to put water in the firepot to wet down the ashes so as to have no dust in the house. We do not use the safety valve. I do not see why that should be necessary at all. We do not usually use radiators. We used a few in the early days, but did not find them altogether satisfactory. We found that the radiation from the boiler in connection with the heat from the gas stove will heat the kitchen sufficiently, and where it will not a register is put in the kitchen from the furnace at very little cost, about $6. I would like to ask Mr. Clabaugh whether he has put these connections in these houses with several families where they have separate heaters, and where the landlord does not furnish hot water or heat? That is a very prevalent condition with us. We have any number of ordinary flat houses with us with from 4 to 12 tenants, and they all have separate heaters. Of course, these people do not feel like paying $10 to get a furnace connection in a rented house. They may move, probably do move once a year. I would like to know if he has any conditions of that kind, and I would like also to know how he manages to get that connection make for $6.90, as he mentioned. I have heard of that price for several years, but never could figure it out.

Mr. Clabaugh—Answering the last question first, I will send Mr. Pettes the figures when I get back. We do not have the conditions Mr. Pettes speaks of. Where we have 6, 8 or 10 families in a place, the heat and water are furnished by the landlord.

Mr. Thomson—Regarding the small furnace in the small house, I think we have tried to use too large a pipe in such furnaces. We are now using a smaller pipe. When I said we used a ¾-inch pipe or a 1¼-inch I meant that it depended upon conditions. Sometimes we go down to within 7 inches of the grate and do not go across the top. We have found that trouble particularly with the hot water heating systems. We have had at times to change the coil so as to get it in the center of the heat zone. We are figuring now on using gas heated radiators in the kitchen, so that you can light this hot water radiator—it is a radiator with which you are all familiar; you can use it in connection with hot water or steam heating. Of course, we will use that radiator in the kitchen, and turn our loop so we can light the gas under the radiator, and it answers the same purpose as the furnace coil.

The Chairman—I would like to ask whether or not the kitchen boiler itself is not sufficient, if kept full of water, to heat an ordinary kitchen?

Mr. Pettes—In my house the kitchen is the most comfortable room in the house. I like a warm house, so does my family; and we run the fire pretty strong. You have to with a hot air furnace, I think, and the boiler is always hot. I have seen installations where they had to draw the water off, it made so much steam in the boiler. It may be of interest to some of the gentlemen here to know that in our district the agent has been able to get a Ruud heater in some of the 2-family houses and the landlord pays the bill, so that the hot water will cost the tenant nothing, but you have to get that kind of installation in a rather high grade of apartment house. The gas bills I believe run about $6 or $7 a month, which is not much of a drain on a landlord when he is getting from $35 to $40 a month for each apartment.

The Chairman—If there are no further remarks I will ask Mr. Thomson to close the discussion.

Mr. Thomson—I do not think I can add anything. I would like to ask Mr. Eavenson, while we are considering making a change from brass to wrought iron and steel, how he tells the difference between them. I think he has made tests on wrought iron and steel.

Mr Eavenson—When I asked the question as to what material was used I did not have in mind brass coil; I had in mind only the so-called wrought iron pipe. Now, your invoices will probably read "wrought iron" pipe, but in most cases I think you will find it steel. When you come to use that steel pipe in the fire you are going to get in trouble with scale. In other words the scaling will be greater with steel pipe than with wrought iron.

A rising vote of thanks was then tendered Mr. Thomson for his very able and interesting paper.

(To be Continued.)

Recent Patent Issues.

Prepared for the American Gas Light Journal by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 10 cents.

952,499. Gas Main Stopper. E. A. Behringer, Brooklyn, N. Y.

952,560. Process of Obtaining Ammonium Sulphate from Gases. N. Caro, Berlin, Germany, assigner to Gewerkschaft der Steinkohlenzeche Mont Cenis, Sodingen, Germany.

952,739. Producer Gas Apparatus. H. P. Hill, New York City.

952,784. Gas Lock Cock. J. T. Clayton, Chicago, Ills.

952,806. Single Diaphragm Gas Meter. A. Henning, Los Angeles, Cal., assignor, by mesne assignments, to Los Angeles Meter Company, same place.

952,822. Gas Governor. M. Lees, Providence, R. I.

952,989. Method of Making Fixed Gas from Liquid Hydrocarbon Fuels. H. A. Grine, Los Angeles, Cal., assignor of one-half to F. C. Nelles, same place.

Gas Stoves and Water Heaters.

Professor Rietschel, acting in harmony with the Heating Committee of the German Association of Gas and Water Engineers, in joint research with the view to further securing of improved methods and means of constructing gas water heaters, declares that their studies are bringing forth results of merit. According to their findings (and no one may say that these are unfair), the construction should be such that even if the chimney draught fails, there should be neither incomplete combustion nor an extinction of the flame. And these requirements are now thoroughly met by the constructions of several firms, amongst whom Houben Sohn Carl, A.G., Aachen, present the latest. Figs. 1 and 2 show a reflector heater, the first under normal conditions, the second under a down draught. In the latter case, it will be seen that the down-draught does not affect the flame, even though the down-draught be replaced by an artificial downpour of carbonic acid gas under pressure.

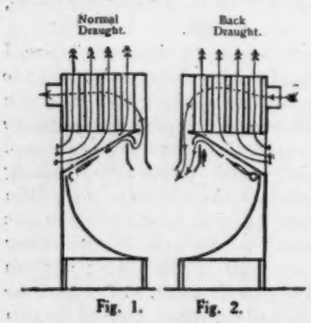


Fig. 1. Fig. 2.

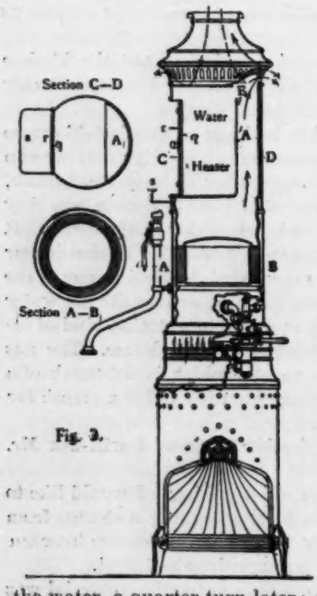


Fig. 3.

With closed stoves, the problem is less easy to solve; but Fig. 3 shows how this is accomplished. Above the proper heater, and behind the water tank, is a space, *A*, at the top of which is the shield, *E*, the effect of which is that a down-draught sweeps into the room, as shown by the arrowheads, drawing the flame products with it; but under normal conditions the products ascend the chimney. Slight modifications of these constructions adapt them to the case of horizontal connections to chimneys. The stopcock is so arranged that water and gas, in a bath heater, may be turned on together with only one handle, the gas coming on a little later than the water, a quarter-turn later; and the rate of flow of the water can then be adjusted by a throttle, so as to give cool, warm, hot or boiling water.

Attempts are being made to avoid over-heating by causing a continuous transport of heat through boiling a small quantity of water, the steam from which condenses upon a metallic surface, and returns as water to be again evaporated. The other side of the metal is in contact with the air of the room to be warmed.

Items of Interest
FROM VARIOUS LOCALITIES.

Now that Dr. J. E. Herbert has secured complete ownership in the Hagerstown (Md.) Gas Company, it is likely that the trading of the concern will be put on a modern basis. The new executive management of the Company is as follows: Directors, A. Armstrong, D. Artz, J. E. Herbert, J. Schindel, L. Hirst, F. J. Posey and Wm. Tice; President, David Artz; Secretary and Treasurer, J. E. Herbert.

THE output of the Brooklyn Union Gas Company, Brooklyn, N. Y., for the first quarter of 1910, exceeded that for the corresponding period of 1909 in the sum of 8.68 per cent. A peculiar thing in this gain lies in the fact that the gain in gas sold on lighting account exceeds that chargeable to "other purposes account" by almost 1 per cent. The total output capacity per diem of all the Company's stations is something under 45 millions cubic feet. It is pretty well understood, however, that a modern station, of possibly 15 to 20 millions daily capacity, will soon be erected on the Gowanus meadows, at a point not far from the Metropolitan branch works.

MR. DAVID H. VAN AUKEN, likely for a 50-year consecutive period Superintendent of the works of the Cohoes (N. Y.) Gas Light Company, retired from its service the 1st inst. Another change in the personnel of the force is the appointment of Mr. Richard Bolton to succeed Mr. "Fred." Ostrander as the Company's bookkeeper.

MR. JOSEPH H. THOMPSON has been elected President of the Nashville (Tenn.) Gas Light Company, vice Mr. D. Shelby Williams—this will give the latter greater opportunity to follow his fancies as a breeder of blooded cattle. At the time Mr. Williams tendered his resignation Messrs. W. R. Cole, A. H. Robinson and Thomas H. Malone handed in their resignations as Directors, but the other members of the Board voted not to accept them. The existing executive management is as follows: President, Joseph H. Thompson; Vice-President, Thomas W. Wrenne; Treasures, V. K. Stevenson; Auditing Committee, J. B. Richardson, W. D. Talbot and Chas. Shinkle; Executive Committee, A. W. Stockell, J. H. Fall and T. E. Matthews.

ADVICES by way of San Antonio, under date of the 24th ult., are to the effect that Mr. W. B. Morse, President of the Gas Operating and Construction Company, of Los Angeles, Cal., has been examining the situation as to going on practically with the construction of a gas works for Guadalajara, Mexico, under the concession granted to Messrs. J. G. Dominiguez and H. N. Sessions. Mr. W. F. Boardman, of San Francisco, who is largely interested in the gas plant at San Louis Obispo, Cal., is also involved in the Guadalajara proposition. Another one who thinks well enough of the project to become connected therewith is Col. H. C. Keyes, of the Sacramento (Cal.) Company.

THE proprietors of the Standard Gas Company, of Keyport and Matawan, N. J., are seeking a franchise to distribute gas to and through Atlantic Highlands, N. J. They ask for a 20-year grant, and agree to charge not in excess of $2 per 1,000 cubic feet, less one-eighth for prompt payment. No works would be erected, it being considered perfectly feasible to supply the district by a low pressure (8-inch) line from the Matawan plant.

ACCORDING to advices from Columbus, O., dated March 28th, to the Columbus (O.) shareholders in the Columbia Gas and Electric Company, of Cincinnati, the deliveries of natural gas through the Cincinnati pipe line for the 6 months ended December 31st, 1909, aggregated 1,932,534,700 cubic feet, growing on a rising scale from 47,486,000 cubic feet in July to 617,560,700 cubic feet in December. President White estimates that the consumption in Cincinnati during the current year will certainly reach 10 billions cubic feet, with 15 billions not by any means an impossibility. The report gives close details respecting the recently concluded merger agreement with the East Ohio Gas Company. A condensed statement on operating account (it is very incomplete) shows that the assets of the Columbia Company are $68,306,467, with a surplus as of December, 31, 1909, of $1,008,718. A conservative estimate puts the earnings for 1910 at $1,600,000 gross, or $600,000 net.

MR. GEORGE H. BARBOUR, Vice-President of the Michigan Stove Works, delivered an exceedingly interesting lecture, on the stove and the kitchen fuel of the future, before a large audience assembled in the Detroit College. He handled his subject from the popular standpoint, and in the narration gave it as his opinion that the time was near at hand when the coal and wood stove would be completely supplanted by the gas stove. One of his citations went to prove the mammoth proportions obtained by the stove industry in Detroit. Over 3,500 hands were given regular employment with stove factories, and the value of the annual output on such account amounted to $3,000,000. An informal reception was held on the conclusion of the lecture.

UNDER the agreement on public lighting account between the authorities of Wareham, Mass., and the Marion (Mass.) Gas Company, the latter agrees to keep the street lamps (electric) ½ hour after sunset to 12 o'clock, midnight, "for every night in each month, except from the night following the one on which the moon is at its first quarter, to and including the night of full moon, all as determined by the 'Old Farmers' Almanac' for the longitude of Plymouth of the year then current, on which nights the street lights need not be lighted, except as hereinafter provided. The Company shall, at the direction of the Committee, or its duly authorized agent, and without extra charge, keep the said lamps burning during said hours,

or any part thereof, upon any of the nights last above mentioned if, in the judgment of the said Committee, or its authorized representative, it shall be deemed advisable on account of dark or stormy weather." The payment schedule agreed on is as follows: For each tungsten lamp of 25-candle power, 31 watts, $1.20 per month; 32-candle power, 40 watts, $1.25 per month; 40-candle power, 50 watts, $1.50 per month; 60-candle power, 75 watts, $1.75 per month.

RATHER misty advices from Boone, Ia., dated the 23d ult., are to the effect that the case before the Supreme Court, known as Pheland vs. the Boone Gas Company, has been decided in favor of the plaintiff. The Company refused to furnish him with gas (he declined when applying for a supply thereof to bind himself to certain pledges exacted by the Company), whereupon he tapped them himself and then requested the Company to set the meter. To the contrary, the Company caused Phelan's arrest. The lower Court held that under the evidence presented the Company was obliged to furnish defendant with gas, whereupon the Company took an appeal. The gist of the opinion is that the Company must furnish gas to all who apply for it, provided such applicant settles his account therefor within "reasonable time."

THOSE of our readers who are interested in the matter should at once apply to Mr. W. F. M. Goss, Director of Engineering Experiment Station, University of Illinois, Urbana, Ills., for a copy of Bulletin No. 36, which has to do with the results of experiments on the thermal conductivity of several commercial fireclays, at high temperatures, as carried out at length and in great detail at the station. A detailed description of the instruments and methods of taking the high temperature measurements is included in the Bulletin.

A MISCELLANEOUS collection of the citizens of Takoma Park, District of Columbia, are considering the advisability of operating the gas supply of that place on municipal account. Another thing which seems to effect the "Takomites" is the sanctity of the Sabbath day, as witness the preferring of a resolution by Brother W. A. Colwood (pretty lugubrious recollections that name recalls) who, as Secretary of the Religious Liberty Bureau, wishes it declared that the Takoma Citizens' Association is against the enactment of any law enforcing any particular day as a day of rest. The resolution was referred to the Committee on the District. It should have been referred to "Bill" Hart, with power to act. If it only were!

AT the annual meeting of the Albion (Mich.) Gas Company the officers elected were: Directors, C. B. Kelsey, John Carveth, C. H. Warden, E. G. Filer and Jas. H. Brewer; President, C. B. Kelsey; Vice-President, John. Carveth; Secretary and Treasurer, J. H. Brewer.

MR. S. A. SEWALL, heretofore prominent in the commercial division of the forces of the Denver (Col.) Gas and Electric Company, has accepted the position of Commercial Manager for the Honolulu Gas Company. He is a son of Dr. J. A. Sewall, first President of the University of Colorado.

OTHER recent advices from Denver are to the effect that Mr. M. E. Malone, Superintendent of the gas division of the Denver Gas and Electric Company, has returned from a year's trip through Europe, completely restored to health. He will not resume his old position, owing to its confining nature, but will manage the Company's coke department, which has been wonderfully developed by the attention and persistence of Mr. Reynolds. The latter will have sole charge of the Company's tar business, which has made amazing progress under his sensible business methods. The demand for tar products, particularly in respect of its use as a roofing material, has doubled during the past twelvemonth.

AT a session of the North Platte (Neb.) City Council, held some evenings ago, an ordinance was adopted repealing the ordinance passed in the fall of 1908, under which Mr. M. F. Springer, of Lincoln, and associates were granted the right to construct and operate a gas plant in North Platte. It is understood that a St. Louis syndicate is about to try for a grant on like account.

MR. H. C. AIKIN, formerly Eastern Sales Agent for the Eclipse Gas Stove Company, has been appointed special business representative on the commercial staff of the Philadelphia Suburban Gas and Electric Company.

THE proprietors of the Taunton (Mass.) Gas Company have petitioned the Board of Gas and Electric Light Commissioners for permission to issue $60,000 new stock, the proceeds of which are to be devoted to paying for the extensive series of plant betterments now being made on the Taunton plant.

THE contract for the laying of 8 miles of gas mains from Bristol to Plainville, Conn,, has been awarded to the firm of E. A. Eveline & Co., of New Britain, Conn.

AT the annual meeting of the Middletown (Conn.) Gas Light Company the following officers were re-elected: President, Mr. N. H. Burrows; Secretary and Treasurer, Mr. H. L. Mansfield; Superintendent, Mr. S. D. Clark.

THE Pennsylvania authorities have issued a charter to the promoters of the Annville and Palmyra Gas and Electric Company. The Treasurer of the Company is Mr. I. L. Buckley, of Reading, Pa.

THE Greeley (Col.) Gas and Fuel Company has been organized to take over all the rights and properties of the existing Greeley Gas Company. The prime movers in the new undertaking are Messrs. Chas. Tew, J. D. McCutcheon, Chas. Darrow and Clarence Darrow, all of Chicago.

THE Clinton (Ia.) Gas Company have contracted with the Gas Machinery Company, of Cleveland, O., for new coal gas condensing, scrubbing and purifying machinery, including an ammonia concentrator.

THE Staunton (Va.) Lighttng Company has been incorporated, the following being named as officers: John M. Spotts, President; C. B. Trenor, Vice-President and Secretary; C. R. Lewis, J. R. Kirakofe, J. H. Hutcheson—all of Staunton.

THE Sunbury (Pa.) Gas Company has contracted with the United Gas Improvement Company for apparatus which will practically mean the rebuilding of its plant. A new 5-foot generating set will be housed in a new fireproof building, and coal elevators, etc., will be included in the apparatus which will make up a thoroughly modern plant.

THE Union Gas and Electric Company, of Bloomington, Ills,, is now in charge of Mr. E. A. Wakeman, who will replace Mr. J. A. Myler temporarily. Mr. F. F. Sparks has also resigned, and Mr. A. L. Frankeberger will handle the outside construction work.

MR. S. B. CORRIGAN has been appointed from Chief Clerk to Manager of the La Grange (Ills.) office of the Western United Gas and Electric Company.

MR. GEORGE W. THOMSON, New Business Manager of the Philadelphia Suburban Gas and Electric Company, whose paper at the last meeting of the Institute appears on page 633 of this issue, was pleasantly surprised a few days since by a handsome present from his Company in the form of a trip to Bermuda. THE new salesroom at Chester, which was recently fitted up largely under his direction, is certainly a beauty.

THE office force of the Spokane Falls (Wash.) Gas Company had a practical lesson in manufacturing the product during a recent strike on the works of that Company, for they donned overalls and kept things going.

THE Union Gas and Electric Company, of Portland, Me., has been incorporated with a capital of $10,000, par $100, with the following officers: President, E. A. Turner; Treasurer, Carl W. Smith; Clerk, Isaac W. Dyer, Portland.

THE Winsted (Conn.) Gas Company entertained the pupils of the Gilbert School of that city recently, by giving them a demonstration of the manufacture, testing, etc., of the gas supply.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, APRIL 4, 1910.

The Market for Gas Securities.

Lighting shares have not shown any greater activity than the rest of the market for the past week, the tendency being toward slightly lower levels.

Brooklyn Union remains the same at 149½–155, while Consolidated shows a loss of some 2 points. The announcement of the Public Service Commission concerning the earnings of the last named have apparently not affected its market value.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

APRIL 4.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$73,177,000	100	141¾	142
Central Union Gas Co. — 1st 5's, due 1972, J. & J.	3,000,000	1,000	98	101
Equitable Gas Light Co.— Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,600,000	100	155	165
New Amsterdam Gas Co.— 1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98½	100½
New York and East River— 1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union— 1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	149¾	155
1st Con. 5's, due 1948, M. & N.	15,000,000	—	95	99
Yonkers	200,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	.65	.70
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	90	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	73	73½
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	20,500,000	100	92	93
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,962,750	100	90½	91
Preferred	3,025,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100½
Detroit Gas Co., 5's	381,000	1,000	75	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	30	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	112	113½
" Bonds, 5's	10,500,000	—	103	103½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	200,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis	10,000,000	100	99½	100
Preferred	2,500,000	100	90	100
Bonds	10,000,000	1,000	104	—
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co. " 1st Mtg. 6's	350,000	1,000	106	108½
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	35,000,000	100	78¾	79½
Preferred	25,000,000	100	95	—
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	109½	109½
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104½	105½
San Francisco Gas Co., Cal.	15,500,000	—	—	—
St. Joseph Gas Co.— 1st Mtg. 5's	751,000	1,000	100	102
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	90	95
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	100	104
Washington (D. C.) Gas Co.	1,600,000	200	347½	350
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	361	—

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., March 9, 1910.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable April 15th, 1910, to stockholders of record at the close of business, March 31, 1910. Checks will be mailed.

1814-5 LEWIS LILLIE, Treasurer.

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Lecturer and Demonstrator of Cookery by Gas or Electricity,

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1805-3m

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Thoroughly experienced in all branches of the gas industry. Can make good and not trust to luck. American, age 35, married.

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Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

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COKING TESTS MADE ON COAL, AFTER CRUSHING AND WASHING, IN OVENS OF DIFFERENT TYPES.

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GLOBE STREET LAMPS.

OVER FORTY YEARS IN USE THE WORLD OVER.

THE BEST STREET LAMPS for ALL KINDS OF GAS OR BURNERS.

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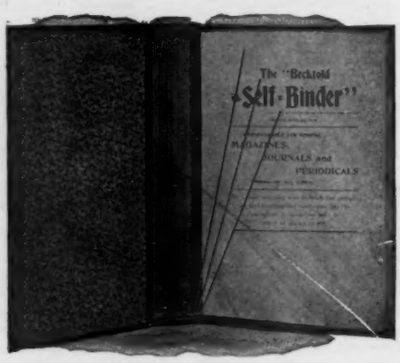
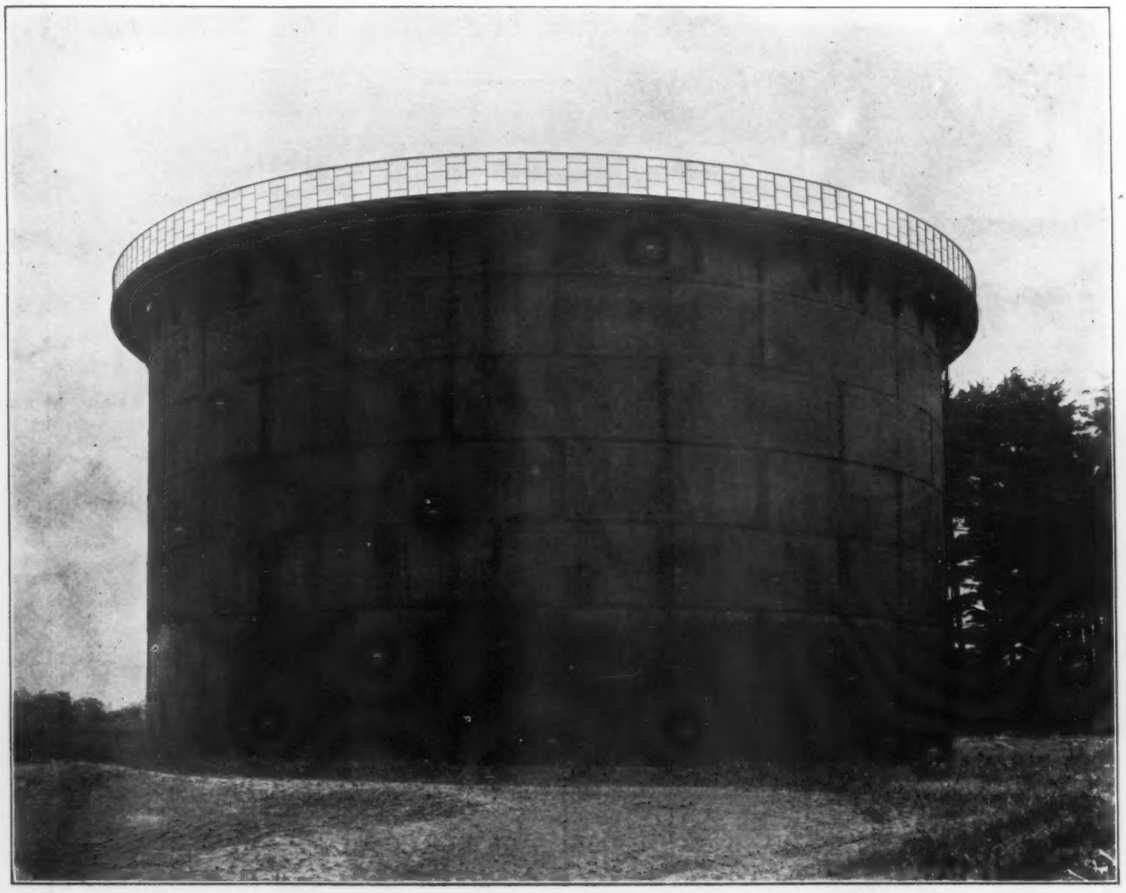


GAS HOLDERS,

STANDPIPES—OIL TANKS—SCRUBBERS—WATER TOWERS,

DESIGNED, CONSTUCTED AND ERECTED.



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GAS WORKS DIVISION, - - - - - - - - - - A. S. B. LITTLE, Engineer.

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Hudson Terminal Building,

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Keasbey, Perth Amboy, N. J.

50 Church Street,
NEW YORK, N. Y.

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"The Only System in Successful Operation."

U. S. Patent No. 904043.
"Process Patent for the Carbonization of Coal in Vertical Retorts."

U. S. Patent No. 801268.
"Operating Mechanism for Bottom Mouthpieces."

U. S. Patent No. 906187.
"Feeding Device."

U. S. Patent No. 899503.
"Retort House."

U. S. Patent No. 915156.
"Recuperation."

388 Benches, with 3984 Retorts in operation and under construction.

TOTAL DAILY PRODUCING CAPACITY, 60,000,000 CUBIC FEET.

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Complete, with

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CONSULTING ENGINEER,
FORMERLY CHIEF ENGINEER AND VICE-PRESIDENT OF
HUMPHREYS & GLASGOW, INC.

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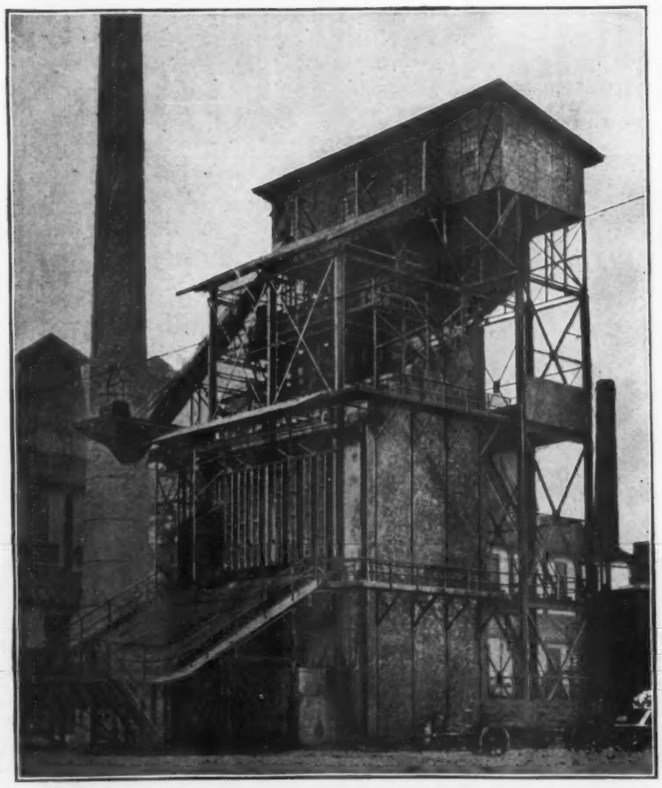
Horizontal, Vertical, or Inclined.



If your output is over 250,000 feet per diem don't fail to consult

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FRED. BREDEL, President.

WM. H. CAMPBELL, Eastern Agent,

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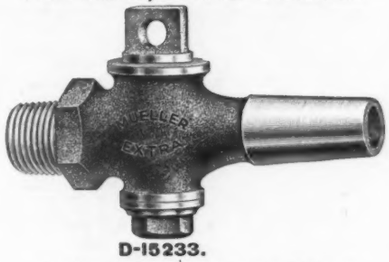

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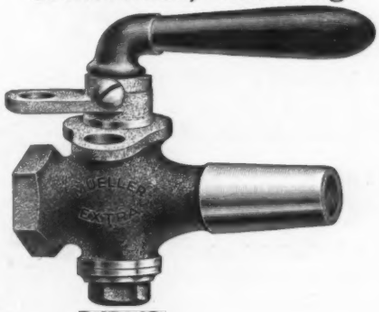
Socket Head, Lock Wing.



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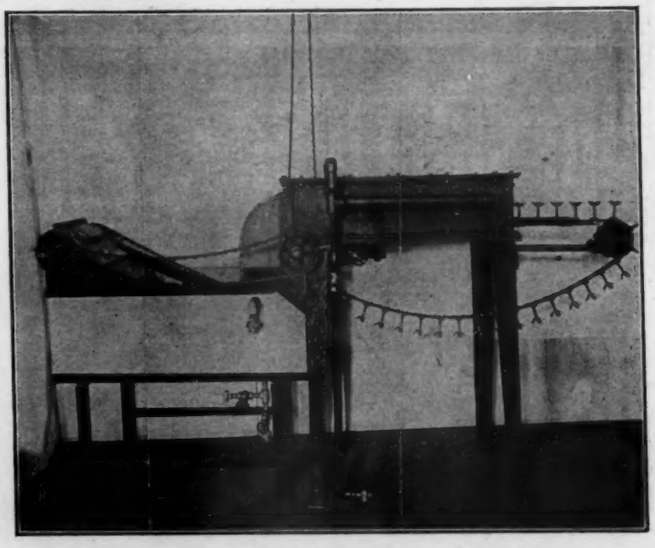

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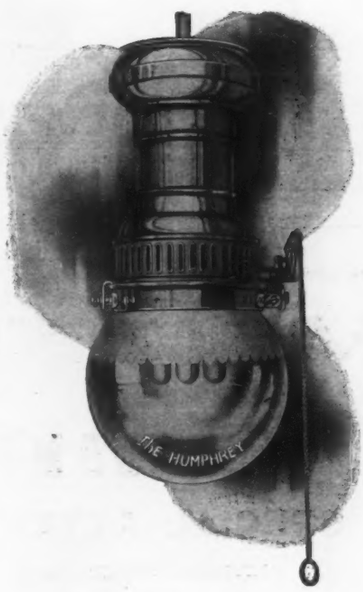

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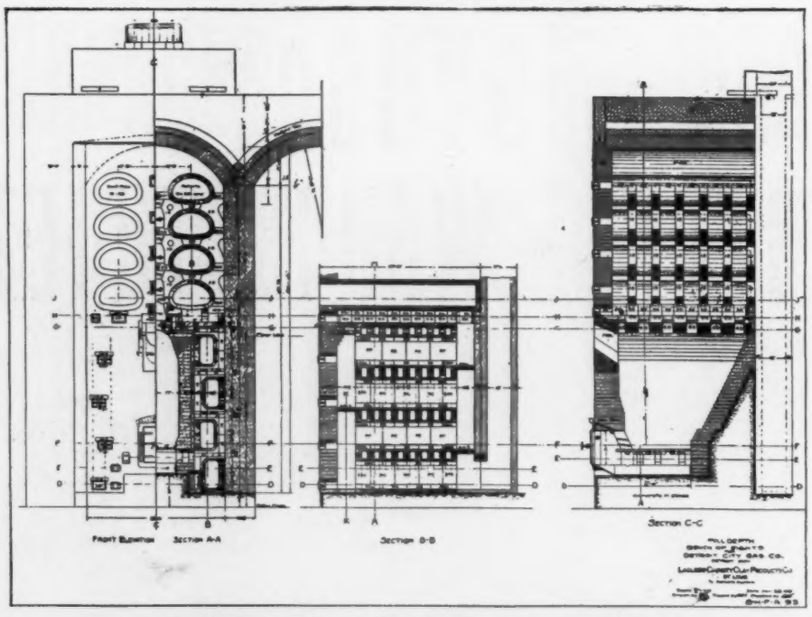

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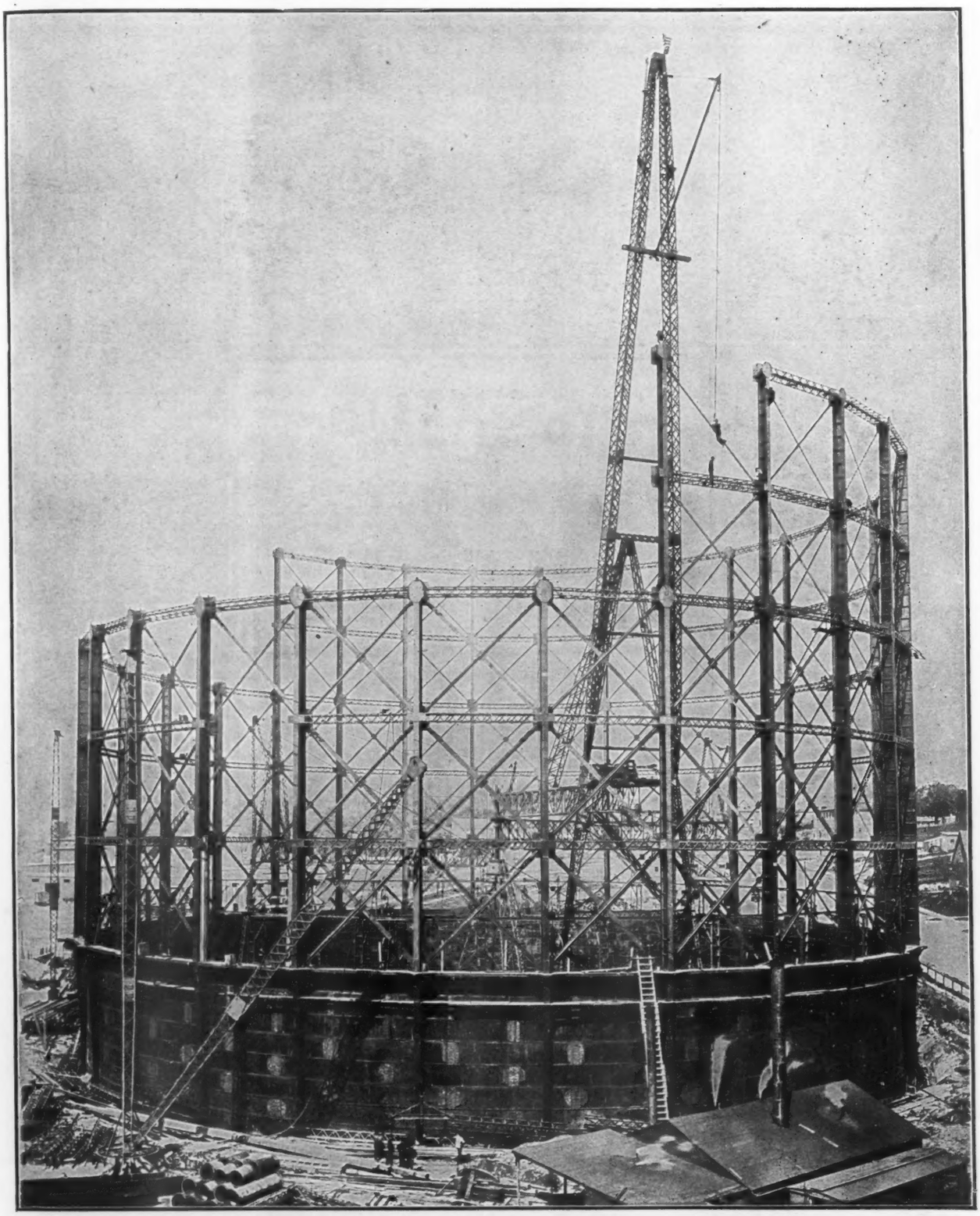

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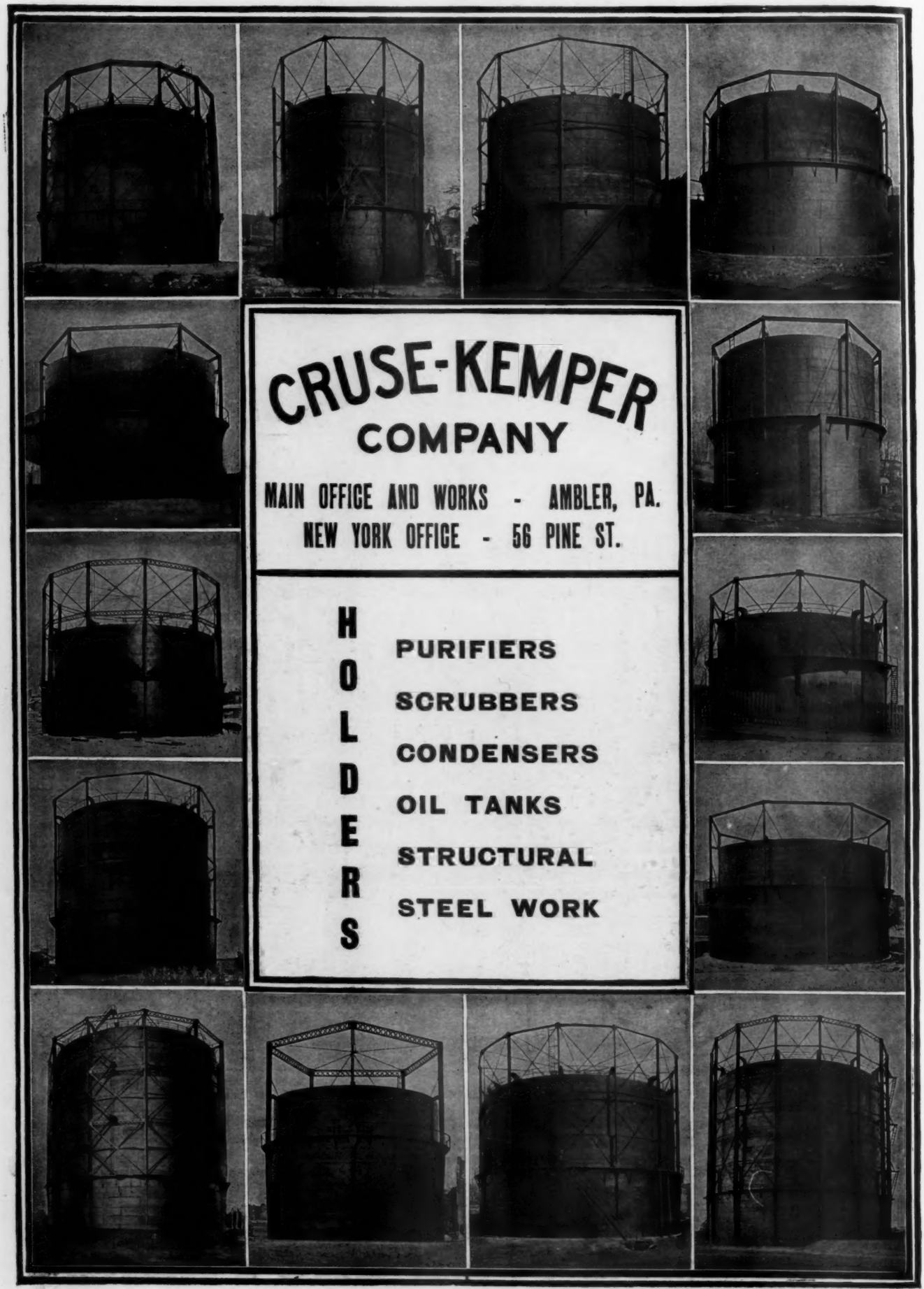
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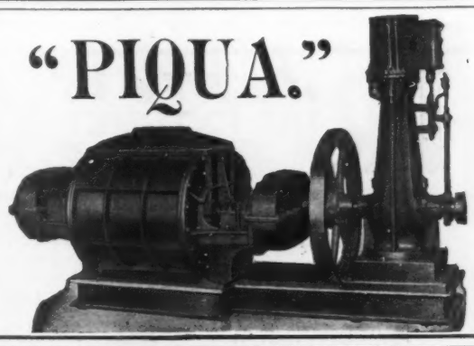

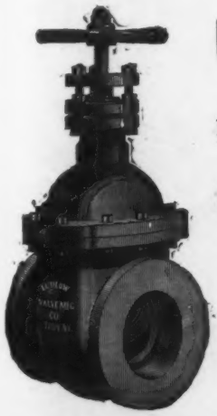

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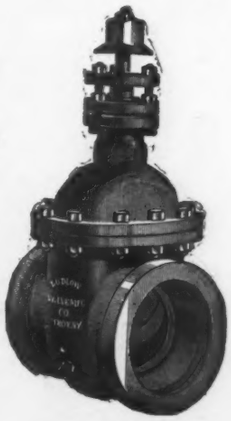

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PUBLIC LIGHTING TABLES FOR APRIL, 1910.

[Communicated by The American Meter Company.]

Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.	Day of Week.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Date.	Complete Lighting in 1 Hour. From Time Given.	Complete Extinguishing in 50 Minutes. From Time Given.
		P.M.				P.M.	A.M.
Fri.	1	6.50	2.10 A.M.	Fri.	1	5.57	4.47
Sat.	2	6.50 L.Q.	3.10	Sat.	2	6.07	4.37
Sun.	3	7.00	3.50	Sun.	3	6.07	4.37
Mon.	4	7.00	4.30	Mon.	4	6.07	4.37
Tue.	5	7.00	4.30	Tue.	5	6.07	4.37
Wed.	6	7.00	4.30	Wed.	6	6.07	4.32
Thu.	7	7.00	4.30	Thu.	7	6.07	4.32
Fri.	8	7.00	4.30	Fri.	8	6.07	4.32
Sat.	9	7.00 N.M.	4.30	Sat.	9	6.17	4.22
Sun.	10	7.10	4.30	Sun.	10	6.17	4.22
Mon.	11	7.10	4.30	Mon.	11	6.17	4.22
Tue.	12	7.10	4.30	Tue.	12	6.17	4.22
Wed.	13	7.10	4.30	Wed.	13	6.17	4.22
Thu.	14	11.40 A.M.	4.30	Thu.	14	6.17	4.22
Fri.	15	12.40	4.30	Fri.	15	6.17	4.22
Sat.	16	1.20 F.Q.	4.30	Sat.	16	6.27	4.17
Sun.	17	2.00	4.20	Sun.	17	6.27	4.17
Mon.	18	2.30	4.20	Mon.	18	6.27	4.17
Tue.	19	3.00	4.20	Tue.	19	6.27	4.12
Wed.	20	3.20	4.20	Wed.	20	6.27	4.12
Thu.	21	3.40	4.20	Thu.	21	6.27	4.12
Fri.	22	4.00	4.20	Fri.	22	6.27	4.12
Sat.	23	No L.	No L.	Sat.	23	6.37	4.02
Sun.	24	No L. F.M.	No L.	Sun.	24	6.37	4.02
Mon.	25	No L.	No L.	Mon.	25	6.37	4.02
Tue.	26	7.20 P.M.	10.00 P.M.	Tue.	26	6.37	4.02
Wed.	27	7.20	11.10	Wed.	27	6.37	4.02
Thu.	28	7.20	12.10 A.M.	Thu.	28	6.37	4.02
Fri.	29	7.20	1.00	Fri.	29	6.37	4.02
Sat.	30	7.20	1.50	Sat.	30	6.47	3.52

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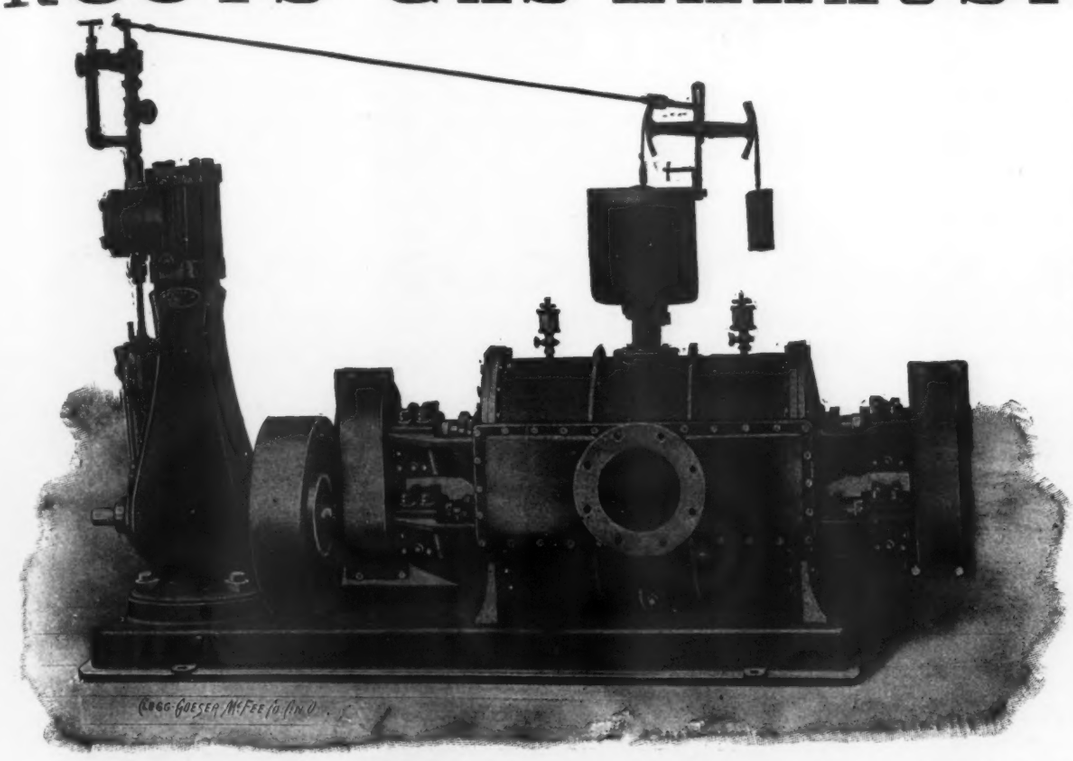

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MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October, 1910. New York City. Officers: President, Wm. H. Bradley, N. Y., City; Secretary, A. B. Beadle, 29 West 39th street, N. Y. City.

Canadian Gas Association.—Annual meeting, June, 1910. Hamilton, Ont Officers President, J. S. Norris, Montreal, P. Q.; Secretary and Treasurer, A. W. Moore Woodstock, Ont.

Empire State Gas and Electric Association.—Annual meeting, Nov., 1910. New York City. Officers: President, C. R. Huntley, Buffalo, N, Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Guild of Gas Managers of New England.—Annual meeting, December. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, A. K. Quinn; Newport, R. I.; Secretary, Walter G. Africa, Manchester, N. H.

Illinois Gas Association.—Annual meeting, time, March, Chicago, Ills. Officers: President, A. S. Harrington, Chicago, Ill.; Secretary-Treasurer, C. B. Strohn, Elgin, Ill.

Illuminating Engineering Society.—Annual meeting, January —, 1911. Meetings of Sections, monthly. President, W. H. Gartley, Philadelphia, Pa.; Secretary, Preston S. Millar, 29 W. 39th street, N. Y. City. Sections: New York: Secretary, Albert J. Marshall, 227 Fulton street. New England, Secretary, L. D. Gibbs 39 Boylston street, Boston, Mass. Philadelphia, Secretary, F. N. Morton, Broad and Arch streets Chicago, Secretary, T. R. Beebe, 157 Michigan avenue,

Indiana Gas Association.—Annual meeting, January 19, 1911, Fort Wayne, Ind. Officers: President, Carl H. Graf, Indianapolis; Vice-President, S. E. Mulholland; Secretary-Treasurer, Philmer Eves, Indianapolis Gas Company, Indianapolis, Ind.

Iowa District Gas Association.—Annual meeting, time, June 23, 24, 25, 1910, Sioux City, Ia. Officers: President, Geo. H. Waring, Omaha, Neb.; Secretary and Treasurer, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, time, ———— Wichita, Kas. Officers: President, W. A. Scothorn, Hutchinson, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association—Annual meeting, time, September, 1910; ———— Officers: President, B. O. Tippy, Grand Rapids, Mich.; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April 14, 15 and 16, 1910; Jefferson City, Mo. Officers: President, W. A. Bixby; Secretary and Treasurer, C. L. Clary, Sikeston, Mo.

National Commercial Gas Association.—Annual meeting, December, 1910: Boston. Officers: President, E. N. Wrightington, Boston; Secretary, Louis Stotz, 36 West 39th street, New York City.

Natural Gas Association.—Annual meeting, May 17, 18 and 19, 1910; Oklahoma City, Okla. Officers: President, William H. McKenzie, Kansas City, Kas.; Secretary, T. C. Jones, Delaware, O. Editor Wrinkle Department, F. W. Stone, Ashtabula, O.

New England Gas Association.—Annual meeting, third Wednesday in February; Boston. Officers: President, W. H. Snow, Holyoke, Mass.: Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

Oklahoma Electric Light, Railway and Gas Association.—Annual meeting, May 18, 19 and 20, 1910; Oklahoma City. Officers: President, F. H. Tidman, Oklahoma City, Okla.; Secretary-Treasurer, Galen Crow, Guthrie, Okla.

Pacific Coast Gas Association.—Annual meeting, Sept. 20, 21 and 22, 1910, Los Angeles, Cal. Officers: President, W. B. Cline, Los Angeles, Cal.; Secretary-Treasurer, John A. Britton, 925 Franklin street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, April 13, 14 and 15, 1910, Easton, Pa. Officers: President, E. G. Holzer, Easton, Pa.: Secretary-Treasurer, William H. Merritt, Lebanon, Pa.

Society of Gas Lighting.—Annual meeting, December, 1910; monthly meeting, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 1123 Broadway, New York.

Southern Gas Association.—Annual meeting, Feb. 16, 1911, Montgomery, Ala. Officers: President, H. W. Frund, Salisbury, N. C.; Secretary-Treasurer, Jas. Ferrier, Rome, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. ————, 1910, Beaumont, Tex. Officers: President, R. B. Stichter, Dallas, Tex.; Secretary's office, 300 Commerce street, Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 11 and 12, 1910, Milwaukee, Wis. Officers: President, R. B. Brown, Milwaukee, Wis.; Secretary-Treasurer, H. H. Hyde, Racine, Wis.

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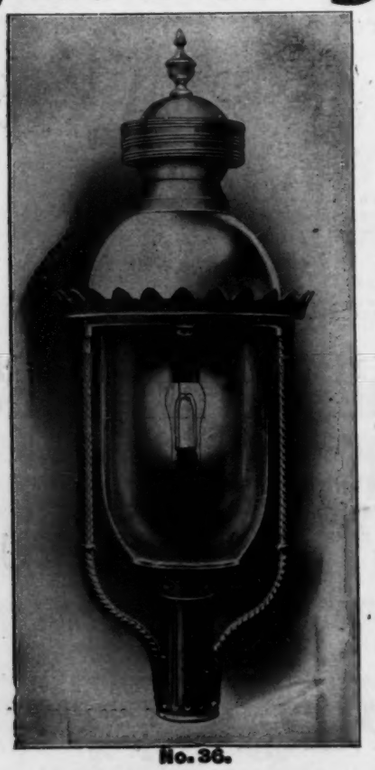

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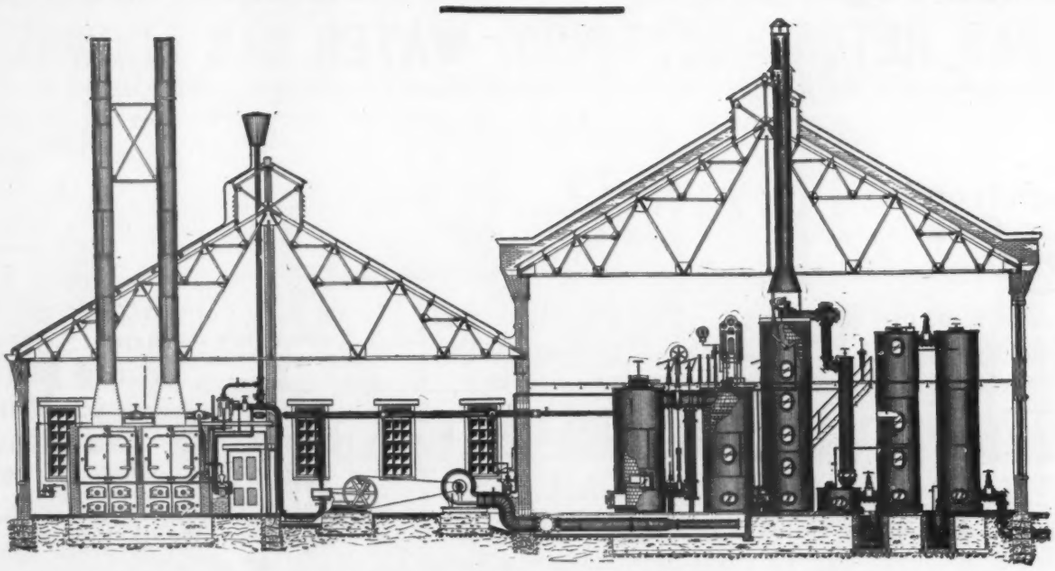

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Belmar, N. J.	St. Albans, Vt.	Brockton, Mass.	Rosslyn, Va.
Abilene, Tex.	Jersey City, N. J.	Rockville, Conn.	Auburn, N. Y.
Pawtucket, R. I.	Everett, Mass.	Bay Shore, N. Y.	Lewiston, Me.
Middletown, Conn.	Burlington, Ia.	Sag Harbor, N. Y.	Moline, Ills.
Weatherford, Tex.	Des Moines, Ia.	Wilmington, Del.	Aurora, Ills.
New Bedford, Mass.	Pelham, N. Y.	Hammond, Ind.	Goldsboro, N. C.
Dallas, Tex.	Pleasantville, N. J.	Sumter, S. C.	Hoopeston, Ills.

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TOTAL NUMBER OF SETS INSTALLED TO JANUARY 1, 1910, ... 721
TOTAL DAILY CAPACITY TO JANUARY 1, 1910, ... 585,590,000 cu. ft.

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Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.
Waste Heat Boiler.
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Meters for Regulating Air and Steam Supply to Water Gas Apparatus.
Emergency Kits for Persons Overcome by Gas.
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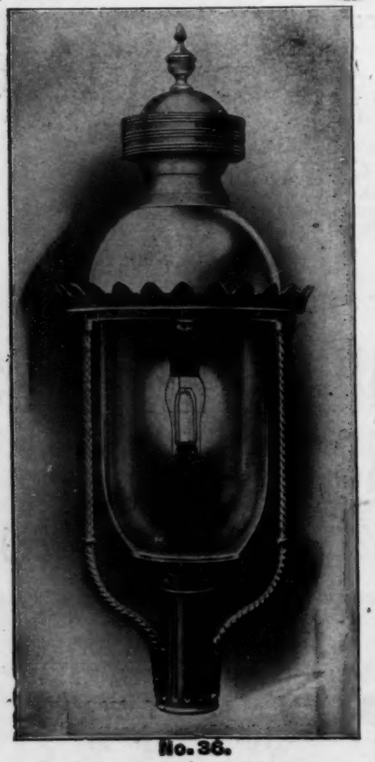
OF AMERICA



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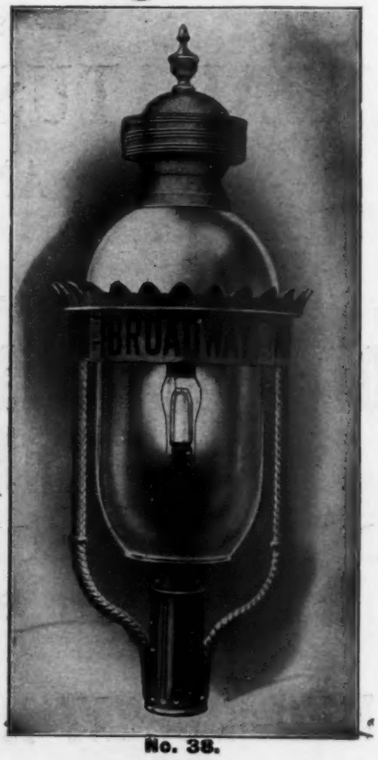

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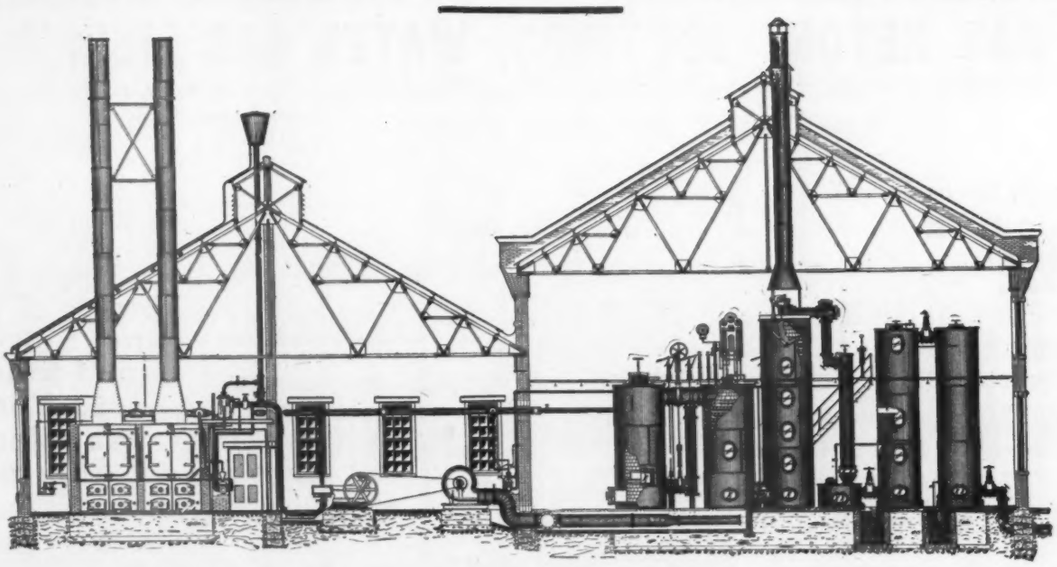

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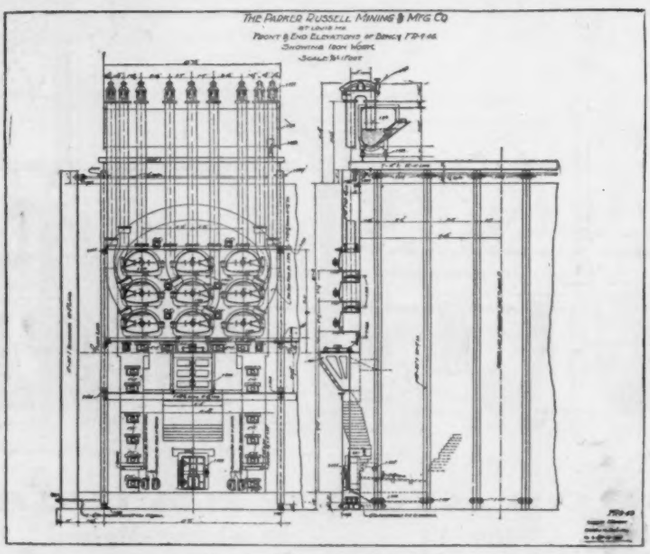

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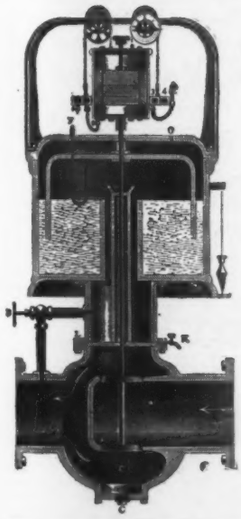

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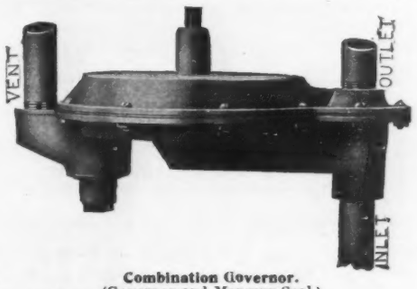

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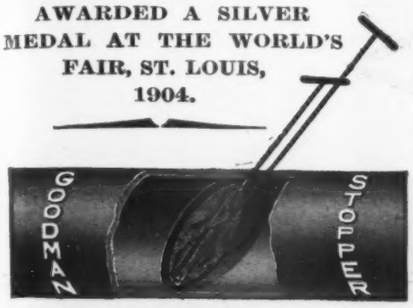

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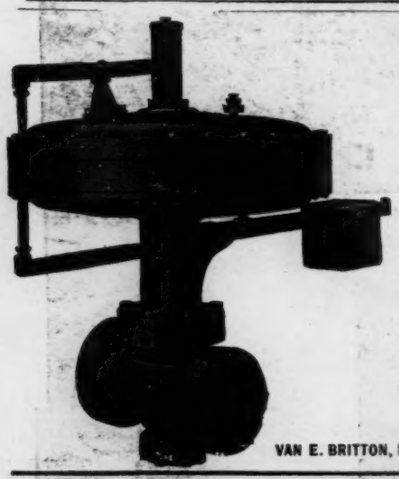

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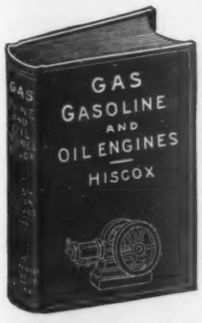

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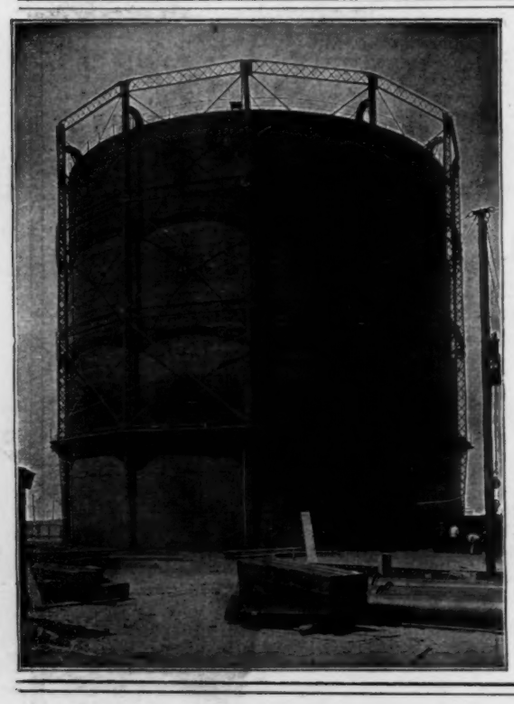

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